GAS

ENGINEERING • UTILIZATION • LOAD-BUILDING • MANAGEMENT

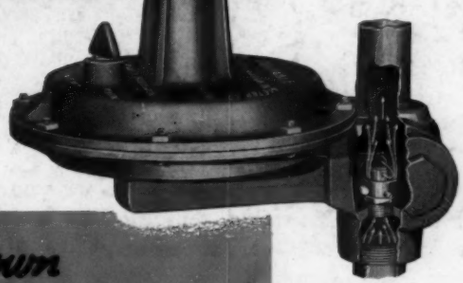
Is Your

DISTRIBUTION SYSTEM

Prepared?

It may be up here to-day

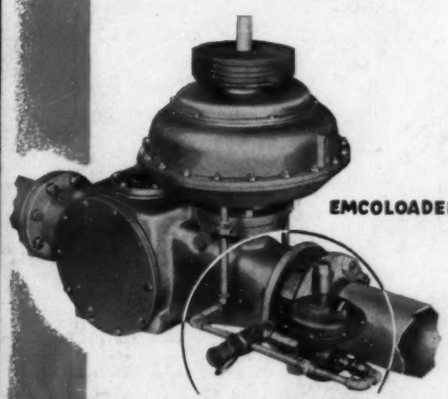
and down here to-morrow



EMCO EJECTOR REGULATOR

The weather man has no pity on the utility company. Rapid temperature changes must be met in stride. Equipment designed to meet the extraordinary demands incidental to the weather man's pranks is an absolute necessity if the gas company is to render trouble-free service regardless of weather conditions.

For EMCO equipment, there is no terror in such unusual requirements. For Domestic Services, the EMCO Type B Ejector Service Regulator provides three definite improvements in service regulator performance—effective automatic loading, low shut-off and increased capacity. Low pressure complaints, normally met with in ordinary service regulator designs, are unknown when the Ejector Regulator is used.



EMCOLOADER

For low pressure distribution systems, the Emcoloader provides a safe and certain means of preventing the existence of troublesome low pressure areas during peak hours. Automatic increase in outlet pressure, varying directly with load, insures customers of maximum satisfaction in spite of the demands on the system due to increased high heating loads.

PITTSBURGH EQUITABLE METER CO.

MERCO NORDSTROM VALVE CO.

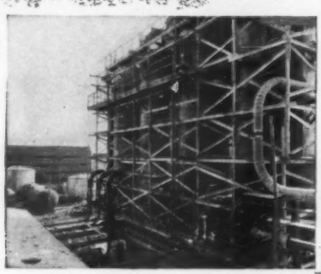
MAIN OFFICES PITTSBURGH, PA.

NEW YORK	LOS ANGELES	TULSA	HOUSTON	MEMPHIS	BUFFALO
COLUMBIA	KANSAS CITY	CHICAGO	PHILADELPHIA	ATLANTA	OAKLAND

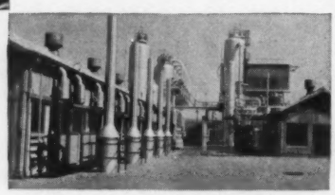
DECEMBER 1937 • • 25 CENTS

Merlin was a mighty handy man to have around. He waved his wand, mumbled a few words and presto—produced any article King Arthur wanted.

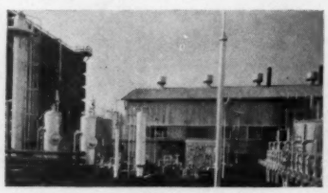
The successful construction of refineries is not brought about by any wand waving. It is, rather, the result of sound design plus competent engineering and construction practices. For more than 46 years The Fluor Corporation, Ltd., has been constructing all types of plants for the oil and gas industry, which have given satisfactory service with low maintenance and replacement costs. The record of Fluor success is built on the policy of assuming ***undivided responsibility*** for every phase of construction—from the clearing of the site to the application of the final coat of paint.



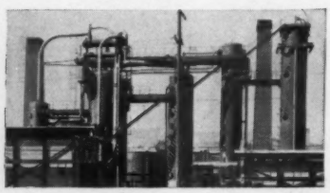
Above is shown a de-waxing plant in course of construction.



First view to the right is of a completed lubricating and de-waxing plant constructed on the Pacific Coast.



Second view to the right is of a cooling tower and compressor plant construction handled for a California oil company.



Third view to the right is of a portion of a California oil company's phenol plant.

FLUOR BE SURE WITH FLUOR **CONSTRUCTION AND ENGINEERING SERVICE**

THE FLUOR CORPORATION, LTD. Main Office: P.O. Box 128—Station K, Los Angeles, Calif. • 909 McCormick Building, Chicago, Illinois • 703 Fairfax Building, Kansas City, Missouri • 934 M & M Building, Houston, Texas 710 Canadian Pacific Building, New York City, N. Y. • 719 McBirney Building, Tulsa, Oklahoma

"NO EXCEPTIONS! EVERY JOINT ON A DRESSER-COUPLED LINE HAS A MADE-TO-ORDER, PREDETERMINED STRENGTH"

You may order your Dresser Couplings for any working pressure you need, and know that every one of them will be identical in strength. And this strength will be scientifically and accurately predetermined by mathematical formula. That's because Dressers are assembled from standardized, precision-made parts—the strength of which can be varied to suit the specified working pressure.

Note to Reader:
This is the eleventh in a series of advertisements dramatizing one engineer's experience with his first Dresser-coupled line. For the complete story, write for Bulletin No. 351.

S. R. DRESSER
MFG. COMPANY, BRADFORD, PA.
In Canada: Dresser Mfg. Company, Ltd., 60 Front St., West, Toronto, Ont.

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GAS

ABP

Reg. U. S. Pat. Off.

Formerly Western Gas

LOS ANGELES	CHICAGO	HOUSTON
810 South Spring Street	1064 Peoples Gas Building	330 Shell Building
Phone MIchigan 1481	Phone HARrison 8536	Phone Capitol 2093

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Publishers: OIL & GAS *Equipment Review;* HANDBOOK OF BUTANE-PROPANE GASES (Two Editions).

"I TOLD HIM 'NOTHING DOING'

I'll stick to Gas!"

CLEAN GAS MAKES SATISFIED CUSTOMERS

Housewives who use clean gas in their modern gas-burning appliances and equipment know that there is nothing that equals gas for economy and general satisfaction. But let complaints come trickling in from exasperated customers about clogged or poorly operating burners, and you open the door to competition. Today clean gas is more essential than ever, due to the delicate mechanisms of modern appliances. No "home-made" gas cleaning equipment will do the job thoroughly. Safeguard your gas business by installing Blaw-Knox Gas Cleaners that insure clean gas and a minimum of service complaints. Ask any operating engineer.

BLAW-KNOX
GAS CLEANERS

BLAW-KNOX COMPANY · FARMERS BANK BLDG. · PITTSBURGH, PA.

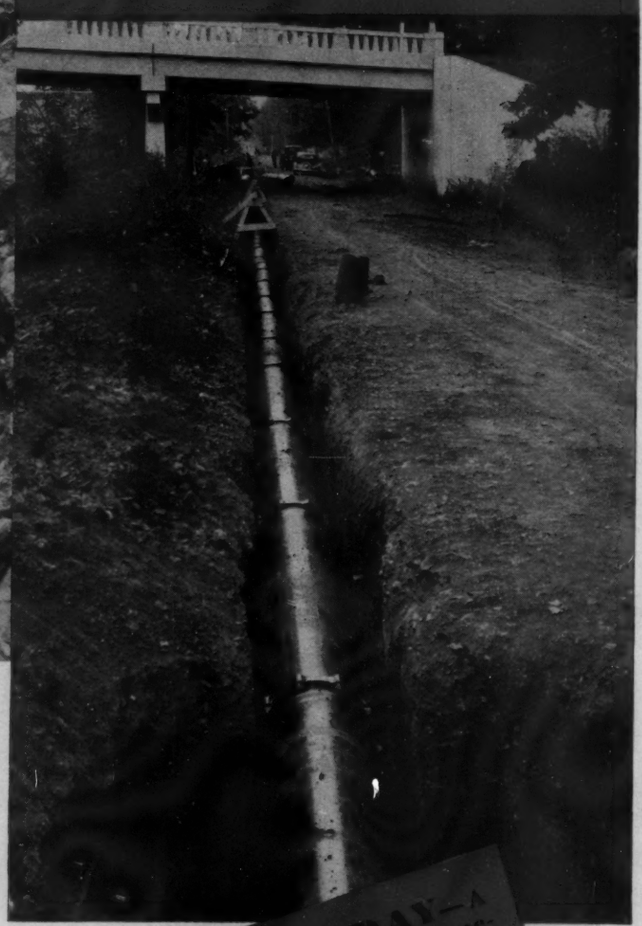
THEN . . .

The same long-lived material

A CENTURY AGO —This cast iron main has been in continuous service in Baltimore for more than 100 years.

and NOW

but with modern mechanical joints



AND TODAY—A recent installation of mechanical joint cast iron pipe for high pressure gas main, replacing another material.

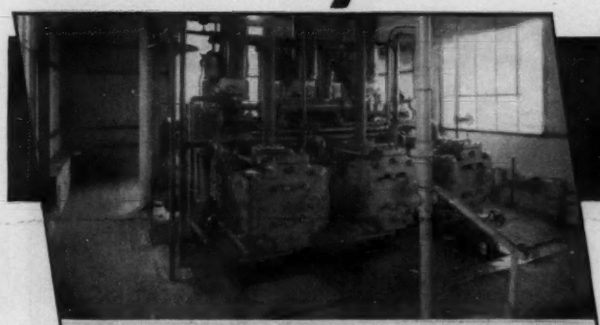
Cast iron pipe helps keep down gas distribution costs even in installation for bottle-tight mechanical joints are assembled swiftly and simply. But the principal factor, today as 100 years ago, is long life. Once down, a cast iron main stays down. Sizes from 1¼ to 84 inches.

CAST IRON PIPE

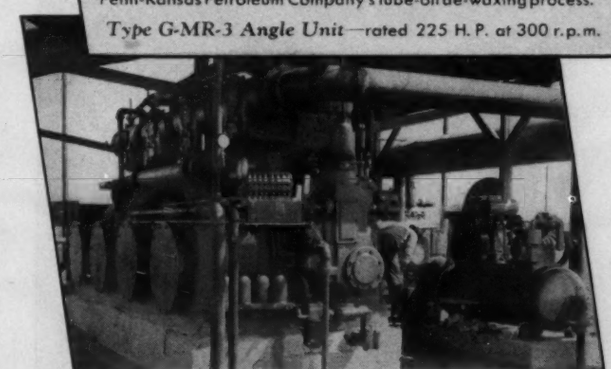
THE STANDARD MATERIAL FOR UNDERGROUND MAINS

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe Research Engr., 1013 Peoples Gas Bldg., Chicago

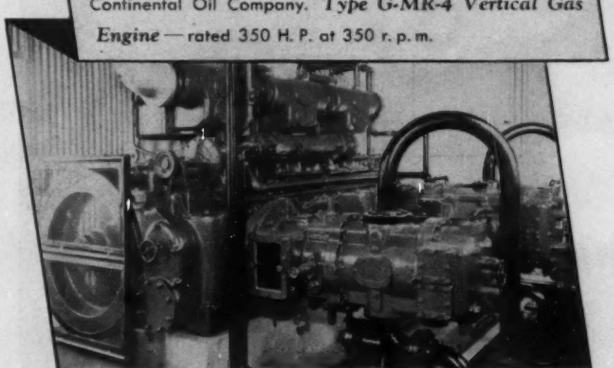
Compact? Sure!



CLARENDON, PA.—Compressing propane for refrigeration in Penn-Kansas Petroleum Company's lube-oil de-waxing process. *Type G-MR-3 Angle Unit*—rated 225 H. P. at 300 r.p.m.



FENTON, LA.—Driving centrifugal oil pipe-line pump for Continental Oil Company. *Type G-MR-4 Vertical Gas Engine*—rated 350 H. P. at 350 r. p. m.



SAN MIGUELITO, CALIF.—Pumping dry gas from Continental Oil Company's Hobson lease into Industrial Fuel Supply Company's main line. *Type G-MR-3 Angle Unit*—rated 225 H. P. at 300 r. p. m.

Type G-MR

BUT THAT'S NOT ALL..

•••The primary purpose of the Cooper-Bessemer Type G-MR is to provide more horsepower in less space. But, in the design of these engines and compressor units, we have been careful to insure ***low operating and maintenance costs,*** and ***long life.***

We invite you to go over the Type G-MR design, point by point, and ***compare*** its reliability and economy with any other two-cycle unit in the power range of 150 to 300 H. P.

You'll find the G-MR "better engineered!"

COOPER CB CORP. BESSEMER

THE COOPER-BESSEMER CORPORATION

640 EAST 61st STREET . . . LOS ANGELES, CALIFORNIA

25 West 43rd St., New York City Mills Bldg., Washington, D. C. 631 Spring St., Shreveport, La. 201 East 1st St., Tulsa, Oklahoma Magnolia Bldg., Dallas, Texas Esperson Bldg., Houston, Texas

Mount Vernon, Ohio — PLANTS — Grove City, Pennsylvania

Goodbye to Scale trouble!

. . . *install* NATIONAL SCALE FREE PIPE

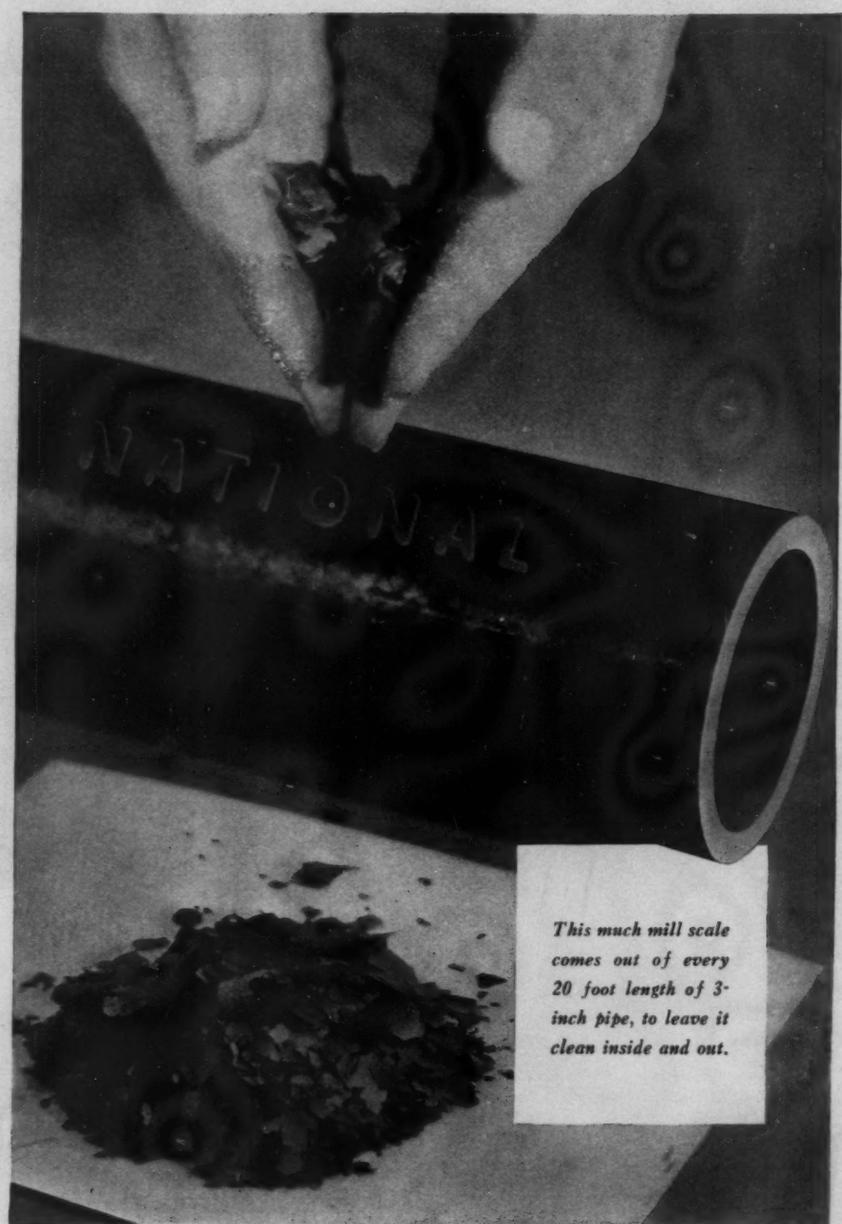
USE NATIONAL Scale Free Pipe and get rid of costly trouble caused by mill scale. Its smooth, clean interior makes it highly desirable for gas service lines because it has nothing which might clog small orifices, injure meters, or otherwise harm service. Mill scale is removed mechanically from NATIONAL Pipe—butt-weld sizes ½ to 3 inches.

IT IS SPELLERIZED
— to resist corrosion

This removal of mill scale, plus the special Spellerizing Process applied to butt-weld sizes 4-inch and under, gives NATIONAL Scale Free Pipe extra resistance to corrosion. Avoid costly repairs or replacements by specifying or ordering NATIONAL, the original Scale Free Pipe.

ADVANTAGES

1. Minimized corrosion—particularly pitting.
2. Better base for galvanizing or other protective coatings.
3. No damage to valve seats; no clogging of small orifices.
4. Greater strength at the weld—due to the extra rolling in the process.



This much mill scale comes out of every 20 foot length of 3-inch pipe, to leave it clean inside and out.

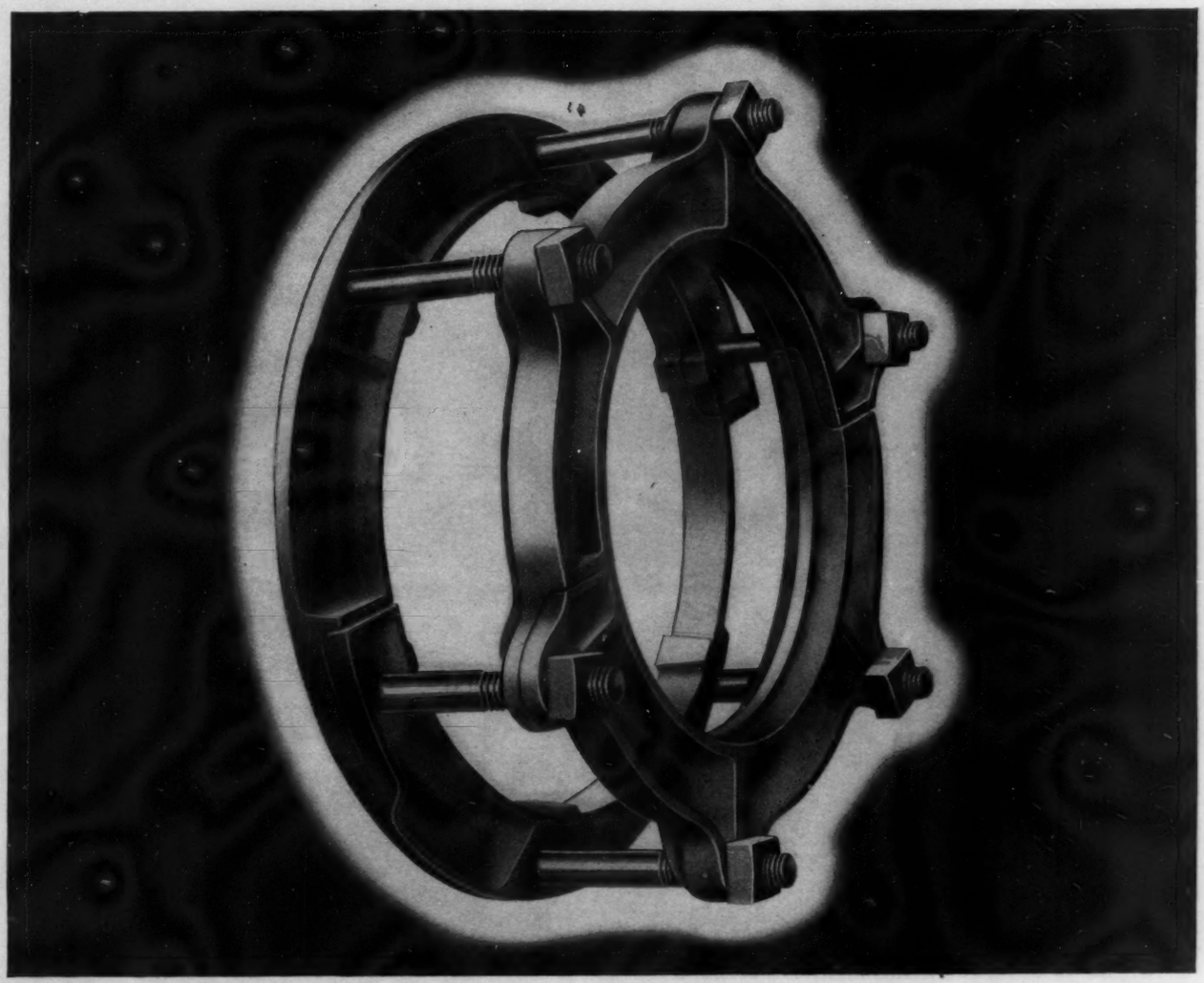
NATIONAL
Scale Free
PIPE

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL



Dayton BELL JOINT CLAMPS

Simplest design of any similar clamp on the market today. Ease of application is assured.

●

Hand sledged for even bearing completely surrounding spigot and as a test of perfect annealing.

●

Extremely heavy construction of sections to prevent any possible distortion in drawing up.

●

No adjustments are necessary. The clamp is tailored to the joint.

THE NATIONAL SUPPLY COMPANY · TOLEDO · OHIO

DAYTON COUPLING DIVISION

CUT YOUR ANNUAL COST

with Anaconda Copper Tubes for small mains and services

SEVERAL well-known utilities have found that the *far superior durability* of Anaconda Copper Tubes makes their average annual cost very much less than that of rustable lines. In fact, experience has indicated that, when used for small mains and services, the rate of corrosion on copper is only about one-tenth as rapid as on rustable metals.

Small wonder that Anaconda Copper Tubes are being used increasingly by the gas industry... especially since the first repair job of any consequence to rustable lines would cost far more than the original saving which they afforded.

All Anaconda Copper Tubes are deoxidized to increase corrosion resistance and improve physical properties. And they are carried in stock by leading supply houses in all sections of the country.

What kind of fittings?

The American Brass Company recommends that all copper tubes installed underground be connected by means of flared tube fittings, or special fittings. If solder type fittings be employed, the joints should be brazed or welded rather than soft soldered. Underground lines are frequently subjected to considerable movement caused by constant shifting of the soil. The mechanical joint secured by the flared tube type of fitting is better adapted to such service than soldered connections.

3765

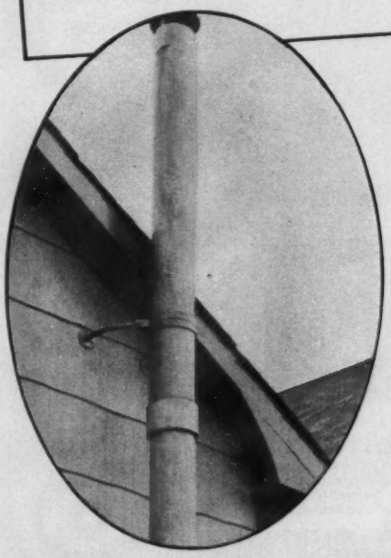
Anaconda Copper & Brass

THE AMERICAN BRASS COMPANY • General Offices: WATERBURY, CONNECTICUT

Offices and Agencies in Principal Cities • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

It's easy to INSTALL this PERMANENT FLUE PIPE!

● *Above*, a typical Transite Flue Pipe job, installed with ease and speed, despite the many bends and small working area. *Below*, corrosion-resistant, weatherproof Transite Flue Pipe solves the outdoor venting problem permanently and economically.



Corrosion-resistant, weatherproof . . . J-M TRANSITE FLUE PIPE is provided with a complete line of fittings . . . and the new J-M Manual gives full data on its quick, economical installation

OBVIOUSLY, ease of installation is a major factor in selecting flue pipe. And just as obviously, flue pipe that offers this . . . PLUS PERMANENCE AND FREEDOM FROM MAINTENANCE AFTER INSTALLATION . . . provides advantages you can't afford to overlook.

Consider the facts on Transite Flue Pipe. Because there is a fitting for every type of job—regardless of how complicated the layout may be—assembly is invariably simple and rapid. Moreover, installation is further facilitated by a complete line of sizes, in both round and oval form.

And once installed, you can virtually forget about Transite Flue Pipe. Asbestos-cement in composition, Transite is inherently resistant to corrosive fumes, absolutely weatherproof. Its durability will serve as a lasting, trouble-free safeguard for the convenience of heating with gas!

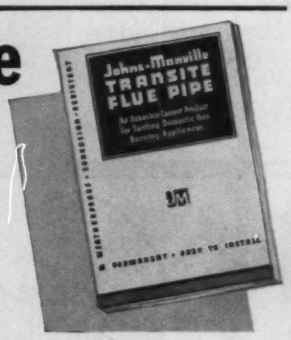
. . .

Furthermore, its relatively low heat conductivity keeps stack temperatures at a high level for long distances . . . minimizes condensation in the flue. Exceptionally resistant to high temperatures, Transite is approved by the National Board of Fire Underwriters! And its cost, considering *all* these evident advantages, is surprisingly low!

Johns-Manville

JM PRODUCTS

TRANSITE FLUE PIPE



Send for new, free manual

New 20-page manual tells how Transite Flue Pipe solves venting problems permanently and inexpensively. Also, information on installation methods and the use of Transite for chimney linings.

JOHNS-MANVILLE, 22 East 40th Street, New York City
Send me your new 20-page manual on Transite Flue Pipe.

Name_____

Organization_____

Address_____

City_____ State_____

G-12-37

PRESENTING ... THE Meriden Universal

1—A COMPLETE MODERN GAS RANGE
2—A POWERFUL GAS CIRCULATING HEATER

● The Meriden Universal is a dual purpose range, combining in one compact unit, occupying only 36 inches of floor space, the services of—(1) a complete gas range; (2) a powerful gas circulating heater which gives an exceptionally high degree of efficient service.

The Meriden is styled to comform to the modern trend in gas range design—it has eye-appeal. The Meriden, equipped with four Simmer-Save Burners, Draftless Precision Oven with Low Temperature Oven Burner and an In-A-Drawer Broiler with Savory Smokeless Broiler Grid, guarantees the highest standard of cooking performance in all divisions of cookery.

Moderately priced, containing every advanced device that would further enhance public appreciation of Gas as the "Ideal Cooking and Heating Fuel", the Meriden is a range that definitely meets the existing need of the Gas Industry for a gas appliance that gives complete gas range utility plus a modern gas heating service.

Universal Precision Oven incorporates devices that make possible certain, simplified results. (1) Low Temperature Oven Burner; (2) Temperature Stabilizers.

The Simmer-Save Burner is a specially engineered device. It is actually two burners in one, containing (1) two burner throats; (2) dual control valve.

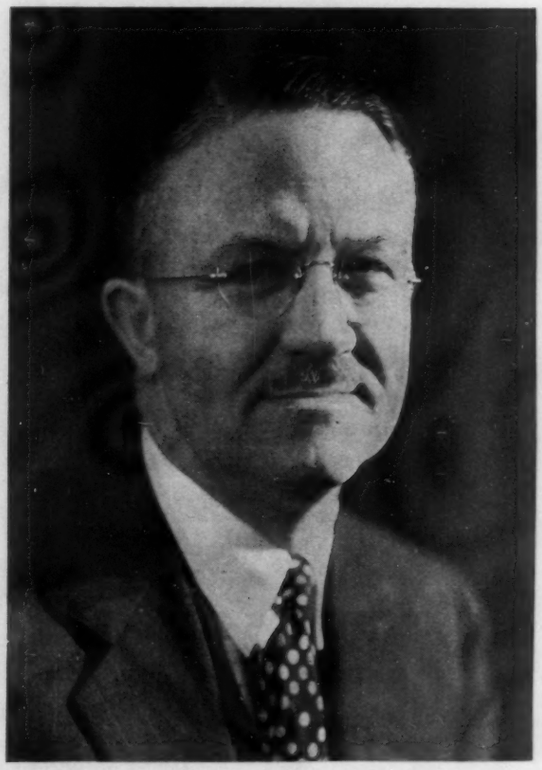
The Universal In-A-Drawer with Savory Broiler Grid makes possible a new advancement in the art and method of broiling. It eliminates smoke.

UNIVERSAL *Gas Ranges*

MANUFACTURED BY CRIBBEN & SEXTON COMPANY • 700 NORTH SACRAMENTO BOULEVARD • CHICAGO, ILLINOIS

GAS
December, 1937

Guest Editorial



"HUMANIZING"

By F. X. METTENET

Vice-President in Charge of Sales
The Peoples Gas Light and Coke Company

THERE is an elevator operator in one of Chicago's larger buildings who, in all the times I have entered his car, never has failed to greet passengers cheerily and with a smile.

In his bearing there is none of this "mechanized" courtesy; he has no stock phrases of politeness which have been given to him to memorize and which he passes on to the public in lack-luster fashion.

Almost as often as not, he knows the floors at which various individuals wish to alight. In many cases, he calls them by name. And whether it be some formidable personage or a messenger boy, he exhibits the same friendliness and courtesy.

One in the utility business cannot help but wish that more of our employees—those in the sales department and other divisions—could meet the public in some way approaching the manner of this elevator man, and radiate his sincere good wishes for his fellow man.

But are the inner feelings of employees something which management can control? To a considerable extent—yes!

Not through personality courses or strictures on "public relations," but rather by first "humanizing" from within, by developing an atmosphere of genuine friendliness—shorn of unnecessary pomposities and formalities which permeate some organizations.

Without the surrender of any of the authority necessary to direct our business, we can so humanize dealings with our salesmen that they naturally will impart this feeling to prospects, and customers.

By their words, inflections and tone quality of their voices, more of them subconsciously will inspire greater confidence. The kindnesses and consideration they have received "at home" within their company, they will translate into prompt, sympathetic and harmonious action in rendering service to the public.

I believe there is no need to elaborate the essential point of all this—that the company with more and more salesmen in this happy frame of mind will increase its business; will progress. And the converse—the company which doesn't recognize the fact that "humanizing" has to begin from within, sooner or later must change its course or face the consequences.

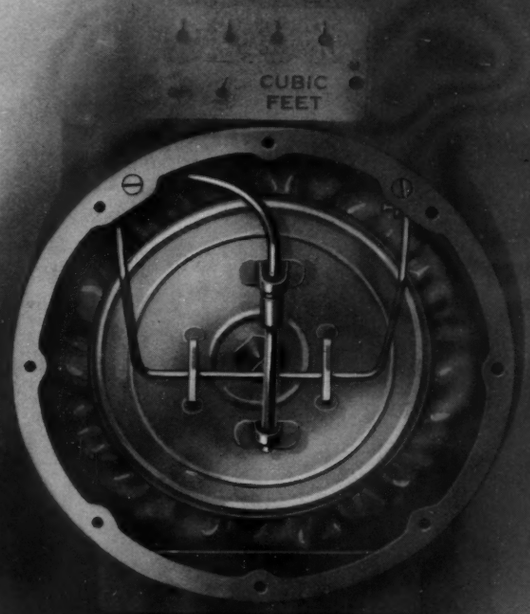
Yes... *and diaphragms!*

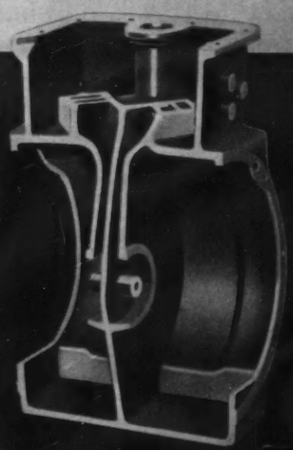
IN METRIC IRONCASE METERS, sustained accuracy of gas measurement begins right at the diaphragm. This follows the approved full bellows principle of design. It is sealed in a leak-proof body casting of one-piece gray iron — formed deep enough to avoid leather contact with corrosion-resistant case.

The back disc is anchored rigidly to the middle partition. Flag rods are so shaped and supported as to produce no unequal motion of fundamental measuring wall.

Ironcase leathers are the product of continuous research to develop the best leather and oils for specific gas conditions. Raw materials, uniformity of grade and thickness, special processing . . . all conform to strict laboratory standards.

Add these and other diaphragm qualities to the many distinctive Ironcase features. You have a proved total of meter accuracy and trouble-free service years. A full range of capacities; high or low pressures.





One-Piece Body Casting
Eliminates Internal Leaks

Volume and Pressure Gage
Charts Hourly Rate of Flow
and Pressure

Established 1836

AMERICAN METER COMPANY
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These and Other Important Features Fully Described in Catalog EG-40

December, 1937

GAS

Vol. XIII, No. 12

THIRTEENTH YEAR OF PUBLICATION

LOS ANGELES
810 South Spring Street

CHICAGO
1064 Peoples Gas Bldg.

HOUSTON
330 Shell Bldg.

GAS Presents This Month

THIS is the time of the year when thoughts turn from football, stock market, and assorted foreign wars to the spirit of Christmas, and all good gas men wish their consumers the best in fortune, the greatest in happiness, and express the sincere hope that their modern service, with a modern fuel, will bring a widespread happiness and comfort during the long winter. Different companies, of course, employ different techniques in imparting this message. A few of these are on display in this month's G A S Camera, which is easily accessible by just turning this page.

A note of encouragement was evidenced last month with the government's changing attitude toward utilities. If this willingness to cooperate should continue, it will stimulate utilities to go forward with long-needed construction and expansion programs, and, incidentally, will encourage the re-entrance of private capital in the securities market.

With the end of the year those merchandising executives, whose very cerebral convolutions spell "sales," gather their forces and concentrate their energies to formulate a parade of colorful ideas which are already on the march to the front line trenches of "Sales in 1938."

Among important sales events of the past month was the appearance of the Servel Electrolux Show —with the new 1938 model and extensive dealer and gas utility cooperative advertising plans in the featured roles. The show played to capacity audiences of dealers and utility sales executives and salesmen throughout the United States. (See Page 55). Of similar importance was the announcement of the A. G. A.—A. G. A. E. M. 1938 National Automatic Water Heater Prize Parade, scheduled to start January 1. The new campaign will follow the successful and just-completed Golden Faucet Contest. (Page 56)

And of course we present with pride our sales-minded "Guest Editor," F. X. Mettenet, vice-president of The Peoples Gas Light and Coke Company, Chicago.

An unexpected and welcome visitor who dropped into the office last month was Ellsworth L. Mills of The Bastian-Blessing Company, on his way from Dallas to San Francisco to Chicago after attending a meeting of the manufacturers and marketers of underground systems for liquefied petroleum gases in Dallas. We wish to thank Mr. Mills again for the story which appears on Page 67.

Christmas presents from the Pacific Coast Gas Association to us which we in turn offer to you are the papers to be presented before the Association's Fall Conference this month. These are preprinted between Pages 16 and 43.

Oil fogging comes in for the major attention with two papers—one on its use in dust suppression by R. G. Holman, and J. L. Oberseider, and another—its effect on appliance performance by T. R. Hayner. The men with the San Diego company have developed a practical pipe locator, and this improved device is described by F. R. Bater.

Many "soil survey" methods for determining soil corrosivity are complicated, time-consuming, and require skilled operators and laboratory equipment. M. T. Burton describes a soil conductivity test apparatus that is easy to operate, rapid, and gives promise of satisfactory accuracy.

The adaptation of the automobile engine ignition stroboscope to gas compressor timing is the topic of Grove Lawrence. The flash of a neon light bulb focused on stripes painted on the flywheel of the compressor shows the exact occurence of the ignition spark.

R. T. Peterson offers a detailed discussion of gas dispatching operations in the Central California area; dealing not only with the normal gas handling procedures, but also with estimates of consumption based on the seasonal and daily temperatures and the weather, and with customer habits and psychology.

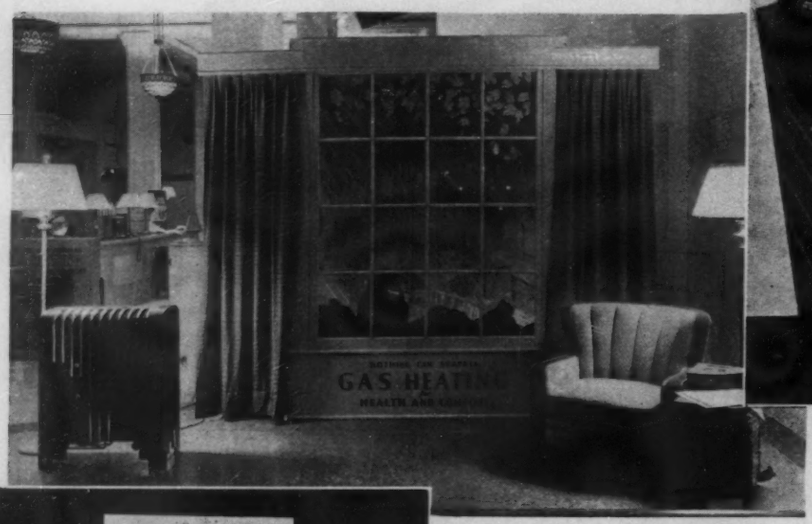
To the December issue of G A S, Volume XIII, No. 12 we give no more words, but to all our readers we extend heartiest wishes for a Merry Christmas and a Happy New Year.

GAS CAMERA

. . . Colorful Displays Build Good Will, Sales During Yuletide Season

WISCONSIN PUBLIC SERVICE CORPORATION featured the Electrolux gas refrigerator in this compelling Christmas display. It was located on a vacant lot opposite the company's office building in Sheboygan, Wisconsin.

CERTAINLY FEW PERSONS could think of a better reason for using gas than has this Santa Claus who has been put to work in the advertising displays of the British Commercial Gas Association.



THE PACIFIC GAS and Electric Company warns its patrons: "If you are planning to build this summer, don't forget that winter is coming." Adequate space heating is best appreciated during the Yuletide.

WHAT COULD BE a more appropriate and more pleasing gift for the lady of the house than a modern gas range? To the man who has spend years in a Christmas-gift quandary, the Brooklyn Union Gas Co. offers the solution of a modern gas range.

A MESSAGE OF Yuletide cheer and gratitude to its patrons and a reverent Christmas display are the expressions of the Northern Indiana Public Service Company in Hammond, Indiana.

Pacific Coast Gas Association

Technical Section

A. B. ALLYNE, General Chairman

The reports published on the following pages will be presented for discussion at the Fall Conference of the Pacific Coast Gas Association to be held at the Fairmont Hotel, San Francisco, California, December 16 and 17, 1937.

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PIPE LINES SUBCOMMITTEE, R. T. Peterson, Chairman

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By R. T. Peterson, Pacific Gas and Electric Company

Oil Fogging Equipment and Practice

By R. G. HOLMAN and J. LOUIS OBERSEIDER
Southern California Gas Company

OIL FOGGING, as practiced by many gas companies today, must be justified on the basis of savings made possible through one or more of the following results:

1. A reduction in unaccounted for gas.
2. Prevention of internal corrosion and dust formation.
3. Control of existing dust.
4. Prevention of the drying of meter and regulator diaphragms.
5. Prevention of the formation of liquid and vapor phase gum.
6. Control of naphthalene.

This report deals only with oil fogging equipment and practice for the control of dust even though other benefits can, and probably do, result. The same equipment and modified practice should be adaptable to oil fogging for other purposes.

Commercial foggers and homemade equipment from other gas companies were investigated. Some of this equipment was modified to fog the first area conditioned. New equipment was developed to increase the persistence of the fog, to increase capacity and to make possible the most economical installation.

Tests were made to determine the optimum operating conditions, the maximum quantity of fog that could economically be injected from a given location, the length of main that could be completely wetted from a given location, the distance that fog will carry, and the effect of oil fogging on the transportation of dust. Cost estimates were made and possible savings determined.

As a result of the tests the practice of oil fogging for the control of dust, at this stage of its development, consists of:

1. Installing high pressure nozzles, using cylinders of propane or a gas compressor as a source of atomizing gas, in outlet lines from governor pits feeding the area. The installation should be made sufficiently ahead of the winter season to complete step No. 2, before dust troubles are likely to occur.

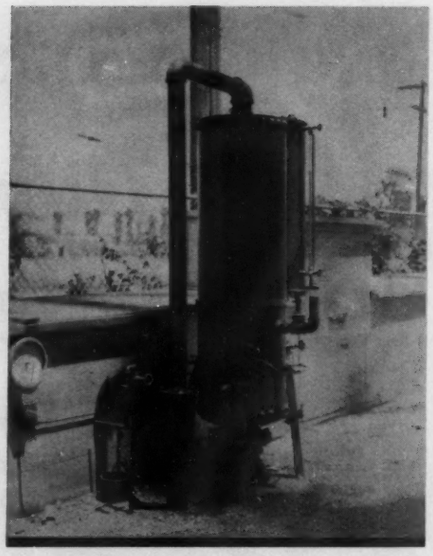

FIG. 2. Original installation at a holder station.

2. Operating these nozzles at the optimum injection rate and gas pressure until the maximum economical quantity of oil has been introduced.

3. Removing the high pressure nozzles and installing low pressure nozzles using gas from the high pressure side of the governor for atomization.

4. Operating these nozzles during the entire winter to saturate the gas entering the area and thus prevent drying out of the previously conditioned main.

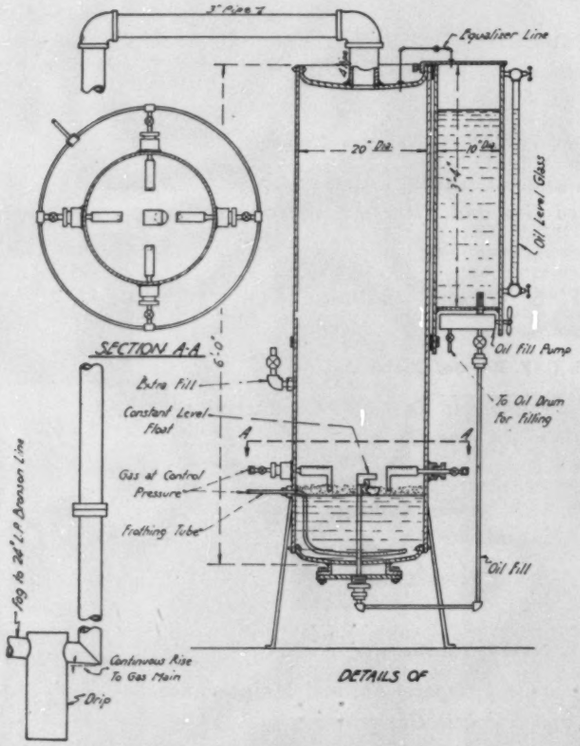

FIG. 1. Details of original installation.

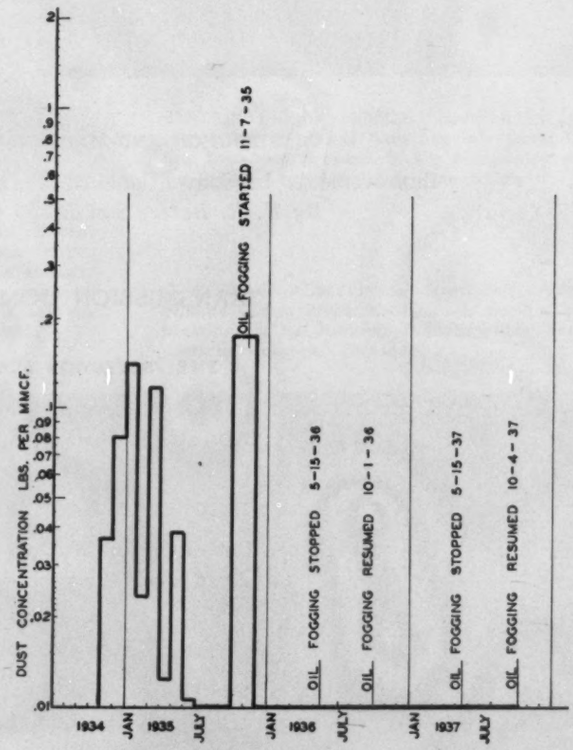

FIG. 3. Effect of oil fogging on gas main dust.

5. Estimating the length of main conditioned from the first location and installing a high pressure nozzle using propane at a distance into the territory equal to this length.

6. Repeating Nos. 2 and 5 until the entire area has been conditioned.

The work showed:

1. That for a given set of conditions there is an optimum rate of oil injection and atomizing gas pressure.

2. That the maximum quantity of fog that can be economically injected from a given location can be determined by plotting total oil remaining in main versus total oil injected.

3. That oil fog will travel at least two and one-half miles.

4. That oil fog will prevent the transportation of dust.

Equipment

There are apparently almost as many oil foggers as there are gas companies using them, but, basically, they all fall into one or the other of two classes—atomizing or cold type, and vaporizing or hot type. The former produces a mechanical dispersoid and the latter, a condensed dispersoid. The mechanical dispersoid, in this case, is formed by dispersing larger masses of oil into finer particles by means of a jet of high velocity gas. The condensed dispersoid is formed by the condensation of oil from the vapor state. This report deals only with the atomizing type fogger; the vaporizing type has been adequately described by Tuttle (reference 3). Our development of oil fogging equipment dates back to September, 1935, when a survey of the oil fogging activities of a number of gas properties in large western cities was made. As a result of the survey, several of their nozzles were tried out; first, on a laboratory scale to determine their capacity, and then on a large scale (see Fig. 1 and 2) to attempt to control the dust in a distribution trunk line, operating at 30-in. w.c., feeding an area subject to dust trouble for years (see Fig. 3). This type of installation has been described by Tuttle (reference 3, 4) and possesses the advantage of low operating costs, but the disadvantage of size and low capacity.

Attempts were made to obtain a high capacity with a minimum amount of equipment by designing a "low pressure" nozzle or "Pitot tube" type that would produce such a persistent fog that it could be installed in a main. The construction of one of the first nozzles of this type is shown in Fig. 4 and 5, together with the method for inserting it into the main. Fig. 6 shows the nozzle installed in the low pressure line leaving a governor pit and the auxiliary equipment

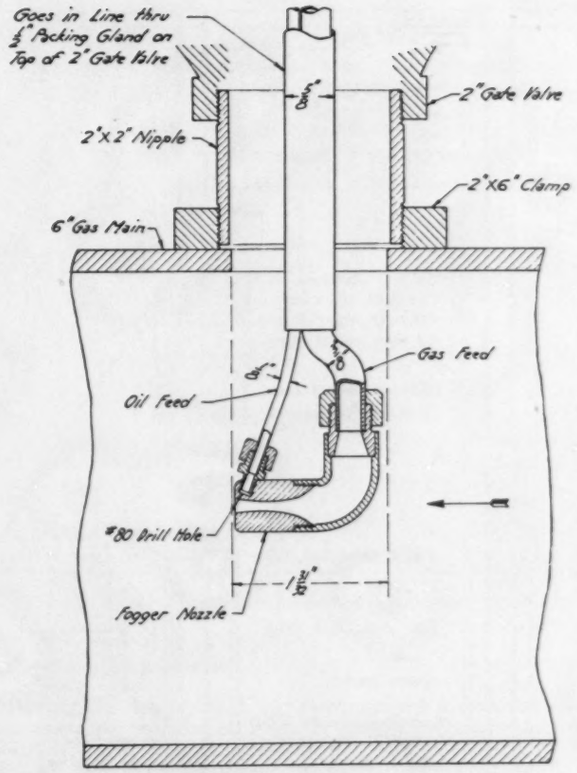

FIG. 4. Details of "low pressure" type nozzle.

located in a gage box above ground for ease of servicing. The quality of fog produced by this type of nozzle depends on:

1. Velocity of the atomizing gas stream.
2. Velocity of the oil stream.
3. Diameter of the oil stream.

Quality should improve directly with atomizing gas velocity, and inversely with oil velocity and diameter of oil

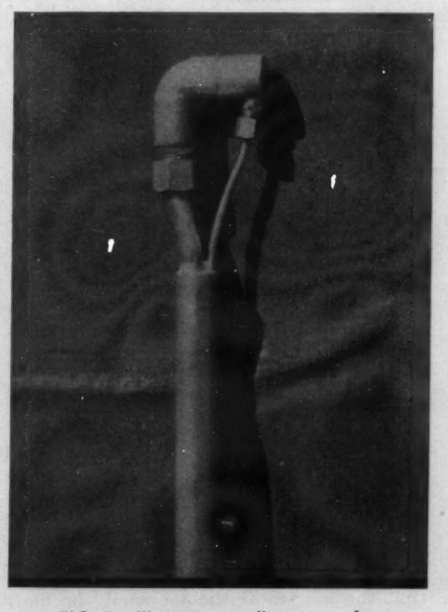

FIG. 5. "Low pressure" type nozzle.

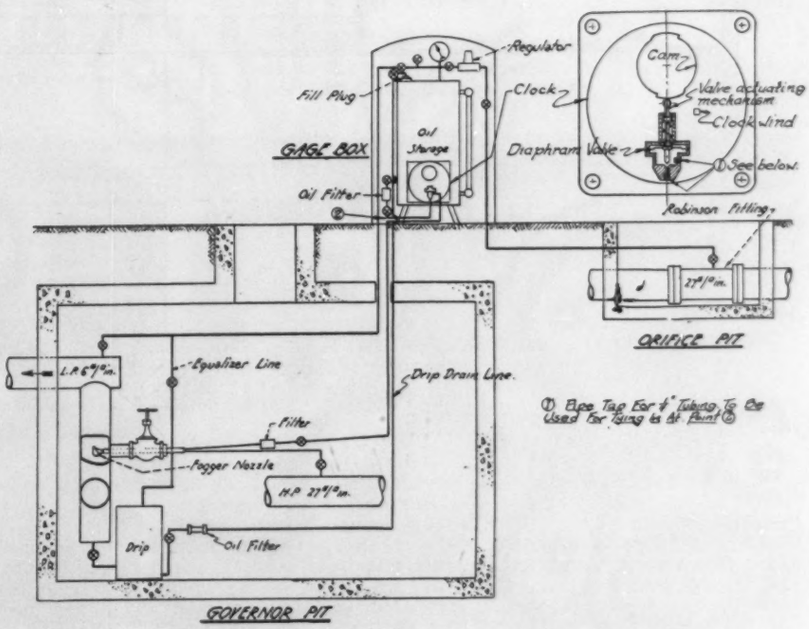

FIG. 6. Installation of "low pressure" type nozzle and auxiliary equipment.

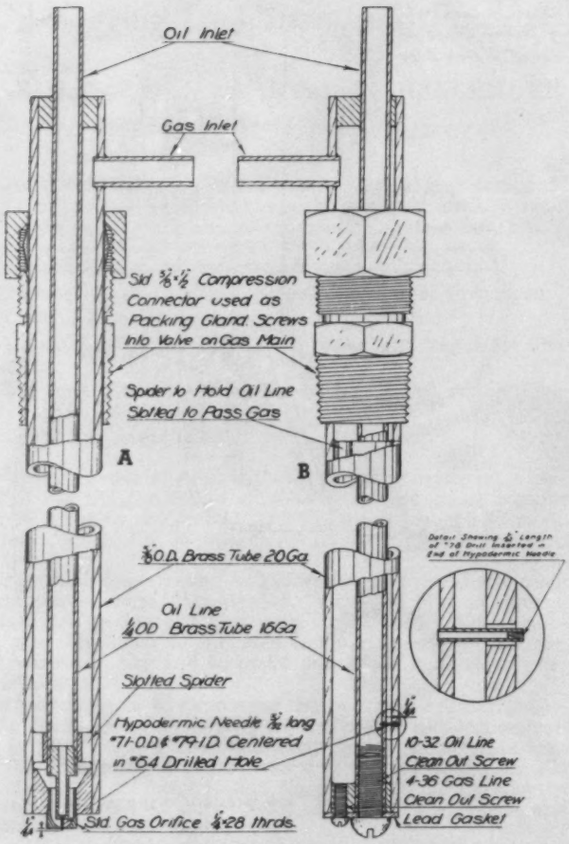
Oil Inlet
Gas Inlet
Std 3/8"-1/2 Compression Connector used as Packing Gland Screws into Valve on Gas Main
Spider to Hold Oil Line Slotted to Pass Gas
A
B
Detail Showing 1/2" Length of #78 Drill Inserted in End of Hypodermic Needle
3/8 O.D. Brass Tube 20 Ga
Oil Line 1/4 OD Brass Tube 16 Ga
Slotted Spider
Hypodermic Needle 5/16 long #71 O.D. & #79 I.D. Centered in #54 Drilled Hole
Std Gas Orifice 1/4-28 thrds.
10-32 Oil Line Clean Out Screw
4-36 Gas Line Clean Out Screw
Lead Gasket

FIG. 7. "High pressure" type nozzle.

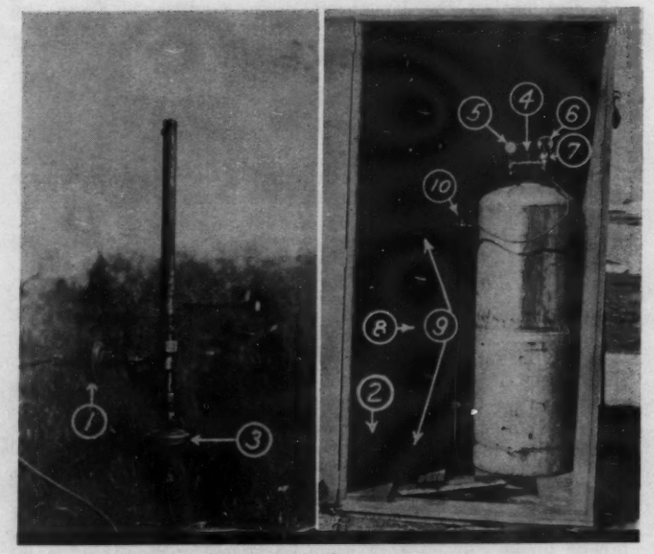

FIG. 9. Installation of "high pressure" type nozzle and auxiliary equipment.

LEGEND

1. One gas filter.
2. One primary oil filter.
3. One secondary oil filter.
4. One adapter.
5. One 0-to-300-lb. pressure gage.
6. One 0-to-150-lb. pressure gage.
7. One regulator.
8. One gage glass.
9. One pair expansion tank gage glass fittings.
10. Three needle valves.

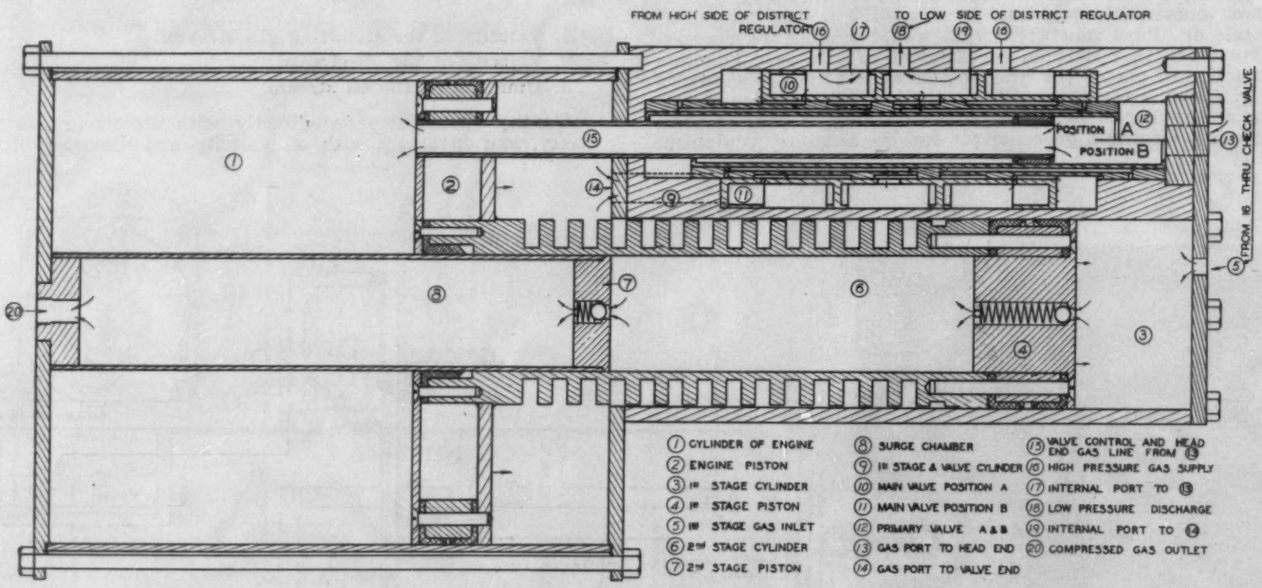
FROM HIGH SIDE OF DISTRICT REGULATOR
TO LOW SIDE OF DISTRICT REGULATOR
POSITION A
POSITION B
FROM 18 THRU CHECK VALVE
1 CYLINDER OF ENGINE
2 ENGINE PISTON
3 1st STAGE CYLINDER
4 1st STAGE PISTON
5 1st STAGE GAS INLET
6 2nd STAGE CYLINDER
7 2nd STAGE PISTON
8 SURGE CHAMBER
9 1st STAGE & VALVE CYLINDER
10 MAIN VALVE POSITION A
11 MAIN VALVE POSITION B
12 PRIMARY VALVE A & B
13 GAS PORT TO HEAD END
14 GAS PORT TO VALVE END
15 VALVE CONTROL AND HEAD END GAS LINE FROM 13
16 HIGH PRESSURE GAS SUPPLY
17 INTERNAL PORT TO 13
18 LOW PRESSURE DISCHARGE
19 INTERNAL PORT TO 14
20 COMPRESSED GAS OUTLET

FIG. 8. Details of gas compressor.

stream. Consideration of these variables resulted in the design and construction of a nozzle that made a maximum gas velocity possible by most efficiently converting the static head in 300 cu. ft. per hour of gas at 25 lbs. per sq. in. pressure into velocity head when discharging into a 10 lb. per sq. in. low pressure line. Oil, under pressure, was injected into the gas stream through a very small orifice in the wall of the nozzle near the exit. The quality of the fog was such as to permit the operation of the nozzle directly in the main. However, an appreciable percentage of the oil injected was recovered as drips, due, it was believed, to the impact of fog particles traveling at high velocity against the walls of the main and slowly moving fog particles in the main gas stream.

In order to improve the overall performance of a fogger, a new nozzle was designed to operate on a much smaller quantity of gas so that the inertia of the jet would be more easily absorbed. The design required a "fogger nozzle" sim-

ilar to that shown in Fig. 4, but so small as to be impractical to make, and a source of atomizing gas pressure more constant than the high pressure inlet to a governor. These difficulties were overcome in the "high pressure" nozzles (A and B) shown in Fig. 7 that use the very small annular gas orifice to obtain high atomizing gas velocities and cylinders of compressed natural gas or propane, or a specially designed gas compressor* (see Fig. 8), as a source of supply. These nozzles apparently were capable of giving a very persistent fog. However, at times a large part of the oil injected was recovered as drips. It seems evident that this difficulty is not due to the physical characteristics of the nozzle, but to conditions existing in the line such as concentration of oil fog, gas velocity, gas pressure, degree to which the pipe is wetted, and characteristics of main approach, internal surface, ells, diameter, etc.

The development of oil fogging equipment and the experience gained over a period of two winter seasons from oil fogging a number of areas subject to dust trouble have led to the choice of what seems to be the most suitable equipment from the standpoint of capacity for producing persistent fog, simplicity, initial cost and operating expense. While it appears that each distribution trunk line should be provided with one or more oil-filled gas cleaners at key locations to adequately protect district governors and distribution mains from incoming dust, oil foggers must be installed in the low pressure outlets from governors and in the distribution mains at a number of points along its length in order to agglomerate and cement dust already present. It seems that the "low pressure" type nozzle, with its atomizing gas supplied from the high pressure inlet, installed as shown in Fig. 6, will best meet the requirement of capacity, simplicity and cost at the governor locations, while the "high pressure" type pictured in Fig. 7 will be necessary at points along the line. The latter type will require, in addition to nozzle, oil storage tank, bottled gas and gage box, the accessories indicated in Fig. 9.

Fogging Oils

Hayner (1) has described tests (see Page 21 of this issue) made on a number of oils to determine:

1. What properties of the oils make one better than the other from the standpoint of atomization, pipe corrosion and ability to wet pipe.
2. What specifications should be set for the ideal fogging oil.

The tests indicate that oils similar to those used are satisfactory for fogging oils and that distillation range, viscosity, atomization, creep, sulfur and corrosion determinations are sufficient for their specification.

* Designed to compress gas to a maximum of 300 lbs. per sq. in. using the pressure differential across a district regulator to operate the engine. The customary prime movers would be impractical due to either fire hazard or location. The design includes freedom from leaks, since there are no external moving parts, and simplicity in construction and operation.

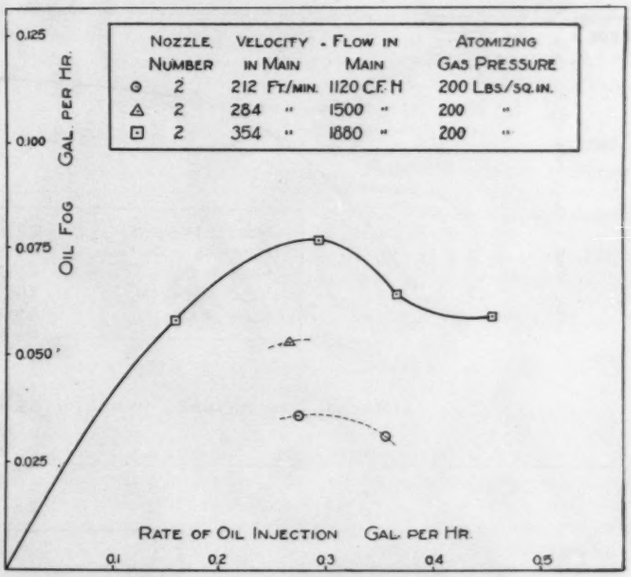

FIG. 11. Effect of rate of oil injection on quantity of oil fog.

Laboratory Development

During the development of the equipment a constant effort was made to practice oil fogging scientifically and economically. When possible experiments were conducted in the field under actual operating conditions. However, when attempts were made to determine the optimum operating conditions in the field the results were obscured by variables over which control was difficult. In order to obtain the desired information, a test main (see Fig. 10) was constructed using 4-in. pipe. A "high pressure" type nozzle, as in Fig. 7A, was used. This equipment enabled one to study one variable at a time and to determine the optimum oil injection rate for velocities approximating those in the low part of the range encountered in the field, the optimum atomizing gas pressure for that rate and the effect of velocity of gas in main on the amount of persistent fog.

The quantity of persistent fog has been plotted against:

1. Rate of oil injection (gals. per hour). (Fig. 11).
2. Atomizing gas pressure (lbs. per sq. in.). (Fig. 12).
3. Velocity of gas in the main (feet per minute). (Fig. 13).

The nature of the curves in Fig. 11 indicates:

1. That as the rate of oil injection is increased the quantity of persistent fog increases rapidly at first, then more

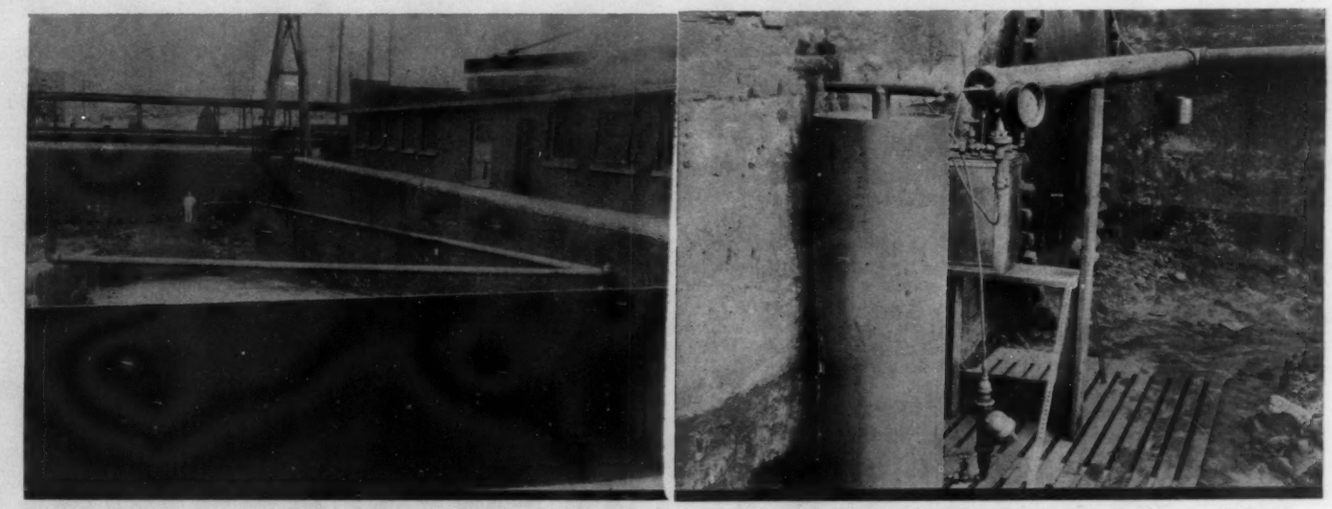

FIG. 10. Views of test main. At left is shown a general view and at right the oil injection end.

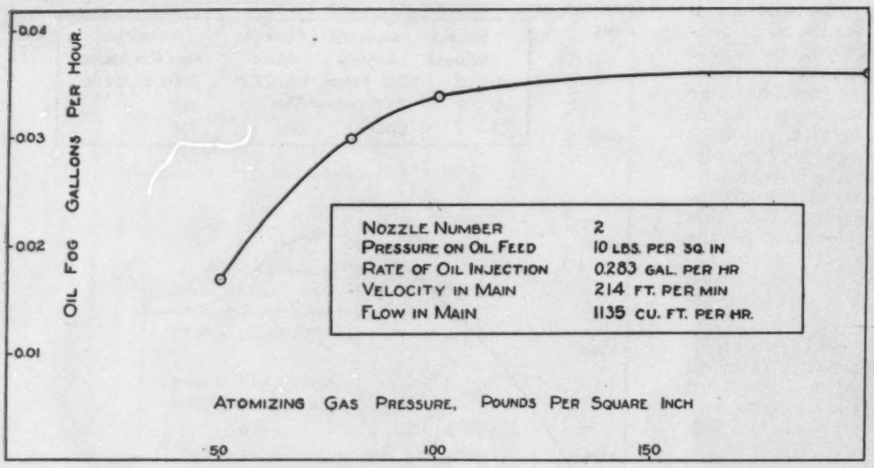

FIG. 12
(at left)
Effect of atomizing gas pressure on quantity of oil fog.

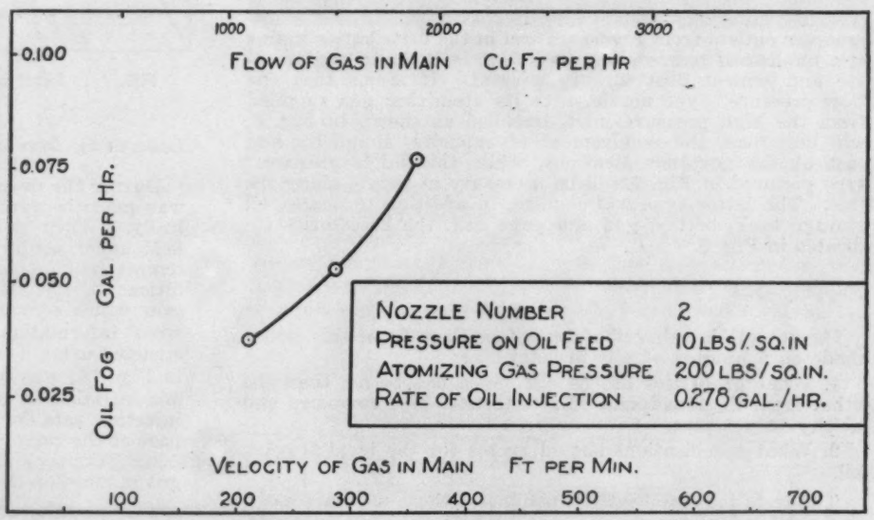

FIG. 13
(at right)
Effect of velocity of gas on the quantity of oil fog.

slowly due to increased contact and precipitation of the particles at higher concentrations and decreased efficiency of atomization.

2. That as the rate of oil injection continues to increase, the quantity of persistent fog reaches a maximum and thereafter declines due to poorer quality fog being formed at the higher injection rates.

The curve in Fig. 12 indicates that for a given rate of injection and gas velocity, the quantity of persistent fog increases with the atomizing gas pressure up to a certain pressure and from then on does not change appreciably.

The curve in Fig. 13 indicates that for a given rate of injection the quantity of persistent fog increases as the velocity of the gas increases, due to a decrease in concentration resulting in less contact and precipitation.

All of this information refers to a given nozzle. The effect of changes in adjustment and construction has to be determined by experiment.

The maximum quantity of persistent fog that can be injected from a given location depends upon:

1. The concentration of the fog at the point of injection into the main.
2. The quality of the fog.
3. The degree of oil saturation of the main.
4. The velocity of the gas in the main.
5. Diameter of main.
6. Characteristics of main approach, internal surface, ells, etc.

Oil has been injected at a number of field locations and precipitated fog withdrawn from "drips." The persistent fog, minus that which goes to saturate the gas and escapes through appliances, was available for agglomerating dust particles and cementing them to the walls of the pipe.

The effect of the degree of saturation of the main on the quantity of persistent fog was observed when curves (showing oil remaining in main versus total oil injected) were drawn from available field data. Such curves indicate that there is an economical limit to the amount of oil that should be injected from a given location.

Some of the variables affecting the length of main that can be completely wetted from a given location are: (1) Size of main, (2) condition of main, (3) velocity of the gas in the main, (4) concentration of fog, and (5) quality of fog.

A few experiments were made to determine the minimum length of different size mains completely saturated by a unit volume of oil:

Pipe Size Inches	Gradient*	Minimum Length Saturated/Gal. Feet	Miles
4	0	617	0.117
6	0	406.5	.077
6	0	465.1	.088
6	16"/10'	925.9	.175
8	0	336	.064

NOTE: The values for 4-in. and 8-in. pipe were calculated from the data on 6-in. pipe.
* Slope of line.

The above values may be used for both internally treated and untreated mains.

From these data and the quantity of persistent fog that can be economically injected from a given location, estimates can be made of the length of main that can be completely wetted from a given location.

Since 1934, transportation of dust has been followed by observing the dust concentrations (reference 5), calculated semimonthly, of the gas at various locations in our transmission, trunk and distribution lines. Fig. 3 shows the effect of oil fogging a 24-inch trunk line.

Field Procedure

As a result of the development work and field experience, oil fogging procedure is divided into two distinct parts: (1) conditioning the gas main and (2) conditioning the gas.

The first part consists essentially of fogging at a rate that results in wetting the greatest length of main in the least time, until the maximum economical quantity of oil has been injected. To effectively fog an entire district this first part will usually have to be done in steps starting at the district governor and progressing into the district by successively fogging from the minimum number of temporary stations (see Fig. 9) using the "high pressure" type nozzle. The second part is carried out to:

1. Saturate the gas with oil to prevent evaporation from the wetted surface of the main.

2. Intimately contact the fog and dust in the incoming gas in order to facilitate its removal from the gas stream.

It is evident that, during the second phase, the rate of oil injection depends only upon the quantity of gas to be conditioned, and this rate must be maintained as long as protection is essential. Since this quantity of oil is considerably less than that necessary to wet the main, conditioning the gas may be performed by the use of "low pressure" nozzles with which atomization is had by virtue of the pressure differential across a regulator.

Cost estimates for oil fogging a district according to the procedure outlined are from 0.4 cents to 0.6 cents per M cu. ft. of gas conditioned.

Conclusions

1. Oil fogging nozzles inserted directly in a main, together with their auxiliary equipment, have the advantage of capacity, size and initial cost over the usual commercial and home-made foggers with nozzles in a separate chamber.

2. Persistent fog not only depends upon the physical characteristics of the nozzle, but also upon such important factors as the concentration of oil fog in the gas, the velocity of gas in the main, the degree to which the pipe is wetted, and the characteristics of main approach.

3. For a given set of conditions there is an optimum rate of oil injection and atomizing gas pressure.

4. The maximum quantity of fog that can be economically injected from a given location can be determined by plotting total oil remaining in main versus total oil injected.

5. The length of main that can be completely wetted from a given location can be calculated.

6. Oil fogging procedure should be carried out in two stages: (1) conditioning the gas main using "high pressure" nozzles, and (2) conditioning the gas using "low pressure" nozzles.

7. Oil fog will prevent the transportation of dust.

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Oil Fogged Gas—Does It Affect Appliance Performance?

By T. R. HAYNER

Southern California Gas Company

FROM time to time the question has arisen as to the effect of oil fogging on gas appliances. A search of the literature revealed that very little work has been done to make available any conclusive information on this phase of oil fogging. Since oil fogging has become of practical value to the gas industry, it is desirable to gain a better understanding of the effects of oil fogging on gas appliances. The following points are often raised when oil fogging is discussed:

1. Plugging of orifices due to gum formation, carbon formation and corrosion.

2. Corrosion, incrustation or carbon and gum formation inside heated copper and aluminum tubing causing tubing to plug or crack.

3. Discoloration of cooking utensils due to burning of fogged oil.

At various times while fogging units have been in operation in the field, reports from distribution field men have reached the laboratory regarding the effects of oil fogging. However, there was such a variety of conditions existing in the field that it was impossible to arrive at any definite conclusions.

It is the purpose of this report to cover the work that has been completed on a group of tests to determine what effect, if any, oil fogging has on appliances. Incidental to the test, a group of oils regarded as being of the suitable type for fogging purposes were given the following laboratory examinations: (1) Specific gravity, (2) distillation range, (3) viscosity, (4) creep, (5) atomization, and (6) corrosion.

The results of the tests were used as a basis in selecting the oils. Table No. 1 and Fig. 1 show results of the tests. The first three are standard tests and the last three are tests devised by the laboratory for fogger oils. The creep test is a method of determining the creep of an oil along a rusty section of pipe versus time. The method consists of dipping the end of a pipe in oil (see Fig. 2) and recording the distance the oil creeps during arbitrary time intervals. The index of atomization is a method of determining the ease of atomization of an oil and the amount of fog produced. The test consists of producing fog from all the oils under identical conditions. The fog is then collected and weighed and the oil producing the greater amount given an index of No. 1, and so on. The corrosion test consists of placing a clean copper strip in a beaker of the oil and placing the beaker in an oven at 212° F. for 72 hours. At the end of this time observations were made for discoloration of the copper strip, discoloration of the oil and amount of sediment. The oil showing the least effect was given a value of "A," and so on. The results were used as a criterion of the corrosive properties of the oils in relation to each other.

From the group of oils tested, oils 0-1, 0-2 and 0-3 were selected to be used in the test apparatus as fogger oils. Oils 0-1 and 0-2 have at times been used in the field for fogging operations.

Fig. 3 shows a single unit of the apparatus. Fig. 4 is a photograph of Unit No. 1 of the test taken while in operation. This setup consists of four units. Units No. 1, No. 2 and No. 3 each pass gas fogged with a different oil, while Unit No. 4 passes non-fogged gas. Each unit consists of an oil fog generator (except No. 4), suitable metering and regulatory equipment, a needle valve type pilot with a No. 70 orifice, an Electrolux burner and a gas range top burner. A single range was used in the test. Each of the four top burners of the range was supplied by gas from a different unit. The oven and top burner pilot were supplied with gas from Unit No. 1. Two sets of coils, each consisting of four feet of copper and four feet of aluminum tubing, were placed in the oven which was operated at 500° F. Through one set oil fogged gas from Unit No. 1 was passed and through the second set non-fogged gas from Unit No. 4 was passed. A dust thimble for measuring dust concentration (see insert

TABLE NO. 1. PROPERTIES OF FOGGER OILS

Oil Number:	0-1	0-2	0-3	0-4	0-5	0-6
Gravity, °A.P.I.	33.6	28.7	29.4	24.9	23.6	28.4
Specific Gravity @ 60° F.	0.8571	0.8838	0.8794	0.9047	0.9123	0.8849
Pounds per Gallon @ 60° F.	7.137	7.355	7.323	7.534	7.597	7.368
Viscosity, Saybolt Seconds @ 100° F.	38	47	71	88	114	51
A. S. T. M. Distillation, °F.						
Over	400	440	510	538	556	220
10 per cent	458	480	564	576	600	320
20 per cent	470	500	576	590	614	560
30 per cent	484	516	590	610	624	590
40 per cent	494	530	604	620	640	608
50 per cent	508	562	616	640	660	618
60 per cent	530	596	630	656	676	644
70 per cent	560	632	652	678	694	662
80 per cent	598	680	680	702	720	692
90 per cent	652	720	732	740	770	738
Dry	728	790	752	758	790	770
Residue, c.c.	4	7	5	6	6	4
Creep. 100 hours (1 is most)	1.0	0.78	0.73	0.69	0.48	0.62
Ease of Atomization (1 is easiest)	1.0	0.972	0.757	0.776	0.619	0.873
Corrosion (A is least)	E	F	A	D	C	B

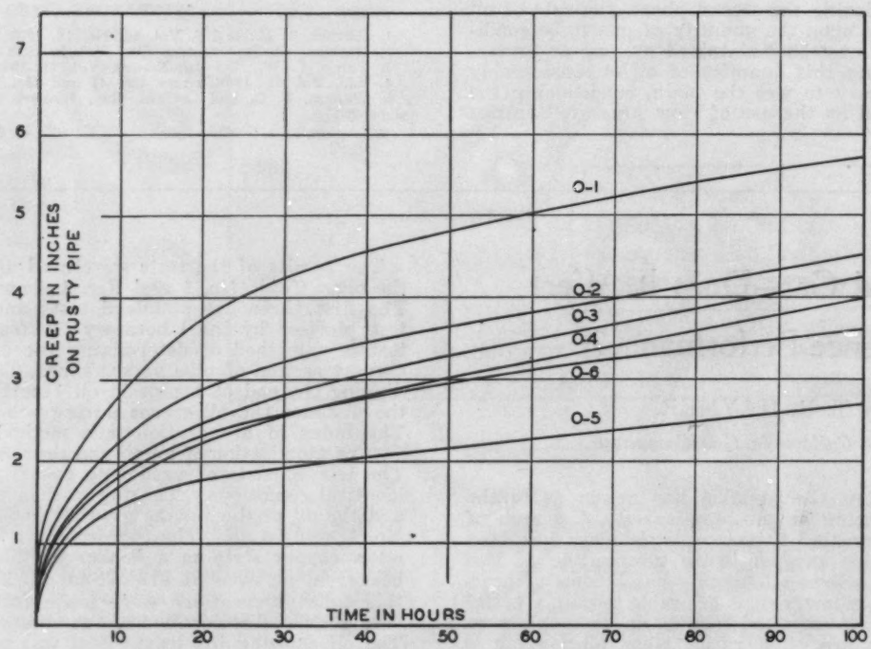


FIG. 1. Creeping characteristics of different oils.

"A," Fig. 3) was placed in the line of the incoming gas.

The oil fog was injected into the gas at a rate slightly greater than 0.5 gals. per 1,000 M c.f. This rate was based on actual field concentrations found on consumers' premises located in the proximity of fogging operations, the highest concentration found being 0.5 gals. per 1,000 M c.f. The average concentration was less than 0.1 gallon per 1,000 M c.f. It was thought advisable to fog at the maximum rate in order that the test might approach the most severe conditions encountered in the field. The range top burners, Electrolux burners and pilots were regulated to burn gas at the rate of 10, 3 and 0.2 cu. ft. per hour, respectively. These are the average field rates. The meters and regulators were set to pass gas at the rate of approximately 150 cu. ft. per hour. The regulators were set at 7 in. water column running pressure.

At these rates it was calculated that it would take approximately two months to get a year's test on the top burners. This calculation was based on the assumption that the average consumer uses 2,500 cu. ft. of gas per month, 900 of which is used for cooking, and that 300 cu. ft. will be the maximum used by any one gas range top burner. Gas was passed through the copper and aluminum tubing at a rate of 15 cu. ft. per hour. Assuming that the copper and aluminum tubing feed pilots burning 0.2 cu. ft. per hour, one hour at this rate would be equivalent to 75 hours of actual field operation. Inasmuch as the Electrolux burners and pilots operate 24 hours per day in the field, there was no way in which a test on them could be accelerated.

The tabulation below shows the average field time obtained from the various burners, and the copper and aluminum tubing.

1. Top range burners—1 year, 5 months.
2. Copper and aluminum tubing—1 year, 3 months.
3. Electrolux burners and pilots—1 month.

During the time the test was in operation daily inspection of pilots, top burners and Electrolux burners was made for change in flame size and stoppage. When the test had been

in operation for a few days the pilot on Unit No. 2 was found to be plugged. Upon inspection this stoppage was found to be due to grease placed in the pilot at the factory. At this point all pilots and burners were removed and cleaned in naphtha. A small amount of grease was found on most of the pilots and burners. Since that time no stoppage or change of flame size was observed on any of the pilots or burners. Incidentally, some of the early pilot outage complaints on new ranges may be due to grease on the pilots.

At the conclusion of the test the pilots, top burners and Electrolux burners were taken apart and inspected. A slight amount of oil was found in all pilots and burners except those passing non-fogged gas. The amount of oil varied from a very slight trace that could be detected only by means of a magnifying glass to that which could be detected by the eye alone. There was no sign of gum formation, carbon formation or corrosion. Slight traces of dust could be noticed on the outward side of the pilot orifices. The inward sides were all perfectly clean. This dust was probably due to dust in the air settling on these orifices when they were not burning gas.

In order to determine whether oil fogging causes utensils to become discolored, new aluminum pans were filled with water and placed on each of the gas range top burners for a period totaling 48 hours. The pans were then inspected and found to be entirely free from any discoloration or carbonaceous deposit.

Along with these observations the following data may be of interest. Assuming the fogger oil to have a value of 150,000 B.t.u. per gal. and the gas to have a value of 1,000 B.t.u. per cu. ft., we find:

1. Each top burner burns 10 cu. ft. of gas per hour.
2. The gas is oil-fogged at the rate of 0.0000005 gals. per cu. ft. = 0.000005 gals. per hr. The oil burned then gives up 0.75 B.t.u. per hour.
3. Of the total B.t.u. per hour from each burner 0.0074 per cent is due to the oil. There is one B.t.u. from the oil to every 13,000 B.t.u. from the gas. Each burner burns less than 0.2 drops of oil per hour.

From this calculation it can easily be seen how little opportunity there is for the oil to cause a carbonaceous deposit on the cooking utensils, or a smoking condition of the burner.

After the equivalent of one year and three months' field test the copper and aluminum tubing were removed from the oven, cut open and inspected. There was found to be no corrosion, incrustation, gum or carbon formation in the tubes. The copper tubing had changed color slightly. The aluminum tubing had not changed in the least. No difference could be detected between the tubes that passed oil-fogged gas and those that passed non-fogged gas.

At various times pressure checks were made on the regulators for pressure variation. None of the regulators showed a variation in excess of 0.3 of an inch water column pressure. The dust thimble on the line of the incoming gas showed a very slight trace of dust.

Providing the rate of oil fogging be kept within proper

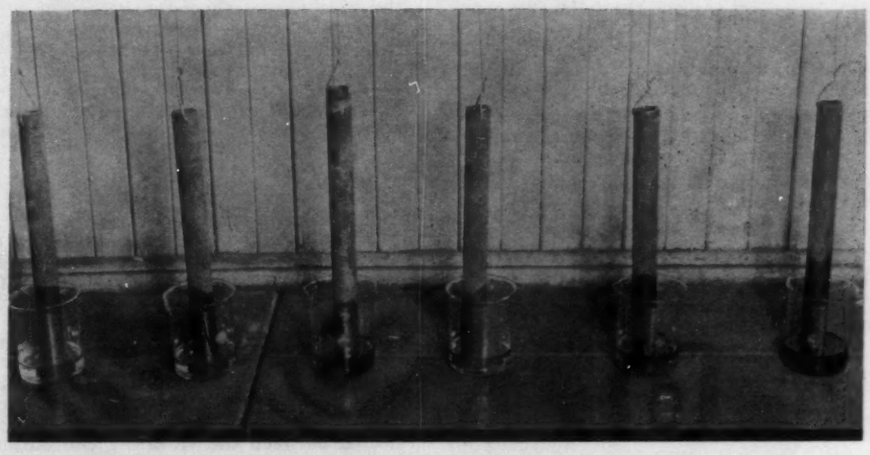


FIG. 2. Creep test.

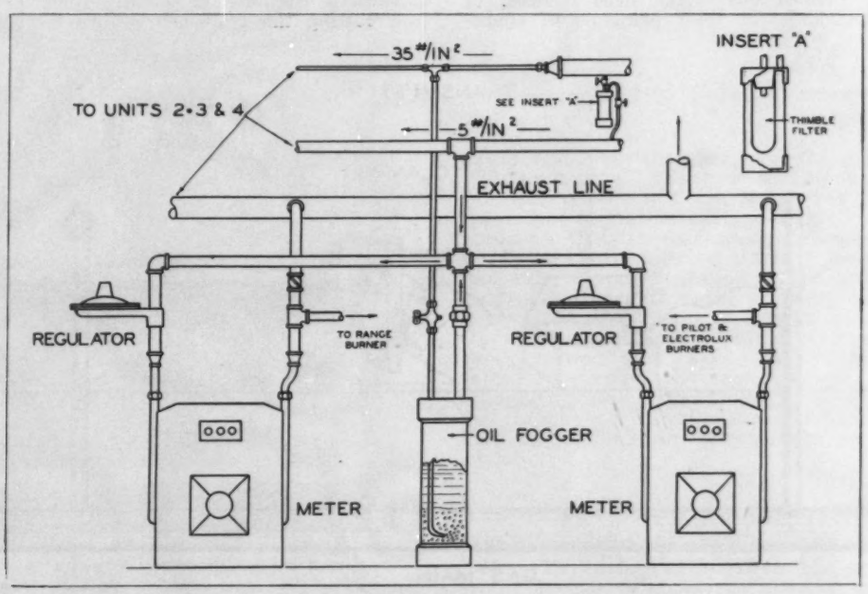


FIG. 3. A single unit of the apparatus.

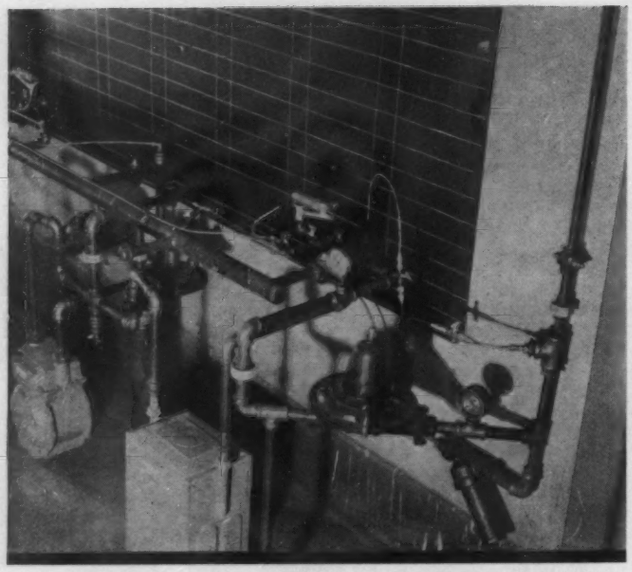


FIG. 4. Unit No. 1 of test showing line of incoming gas.

limits and a satisfactory fogger oil is used, the following conclusions may be made:

1. Oil fogging does not cause plugging of orifices due to gum formation, carbon formation, or corrosion.
2. Oil fogging does not cause corrosion, incrustation, gum or carbonaceous formation inside heated copper and aluminum tubes.
3. Oil fogging does not cause discoloration of cooking utensils due to burning of fogging oil.

Improvements in Conventional Pipe Locator Design

By F. R. BATER

San Diego Consolidated Gas and Electric Company

DURING the past few years several so-called treasure seeking devices have been described in various radio and electronic publications. All these devices, of course, depend on electricity for their principle of operation, although they differ considerably in the way the principle is applied.

One class of these instruments, like those used for finding ore bodies, is exceedingly complicated and requires special knowledge to construct and operate. Another class used for locating metallic objects only a few feet distant is comparatively simple and requires no extensive training to build and operate.

Of this latter class, two or three types have been used successfully for locating underground pipe. One type in particular combines simplicity, accuracy and reliability to such a degree that it has enjoyed a wider use for pipe location work than any of the others. It is the purpose of this paper to describe this particular type of instrument and to list certain improvements that have been made during its several years of use.

In its conventional form the pipe locater consists of three parts: a transmitter for sending an alternating or pulsating current of audible frequency along the pipe; a reel of wire for connecting one terminal of the transmitter to a distant point of the pipe (Fig. 1); and a receiver comprising a flat coil, an amplifier, and a pair of earphones.

Fig. 2 illustrates the way in which the receiver is used to determine the location of a pipe. The circular lines around the pipe represent the magnetic field produced by the transmitter current. With the receiver in position at "A," part of the field is passing through the coil, inducing a weak current which is amplified and heard in the earphones. At "B," directly over the pipe, no signal will be heard. At "C," the receiver is tilted and no signal is heard in the headphones. In general, no signal will be heard when the receiver is in such position that a radius from the pipe passes through the center of the coil and is perpendicular to the coil winding.

A convenient way to estimate the pipe depth is first to locate a point directly over the pipe; then, tilt the receiver 45 degrees and move it to one side of the pipe until the signal is cut out. The pipe depth will be approximately equal to the distance the receiver was moved.

Transmitters

The transmitters described in this paper employ Model "T" Ford coils for converting direct current furnished by dry cells to alternating current of audible frequency. The Ford coil is not necessarily the ideal converter unit; the reasons for its use are that it is easily obtained and that its output can be connected directly to the load without additional impedance-matching transformers.

One type of transmitter (Fig. 3A) that has been used extensively for the past few years utilizes two Ford coils connected as shown in Fig. 3B. The coil with the vibrator locked closed acts merely as an open core transformer connected between the vibrating coil output and the load. The principal advantages of such an arrangement are that it makes use of the secondary windings of the coils and provides a coupling sufficiently inefficient to admit of short circuiting the transmitter output without stopping the vi-

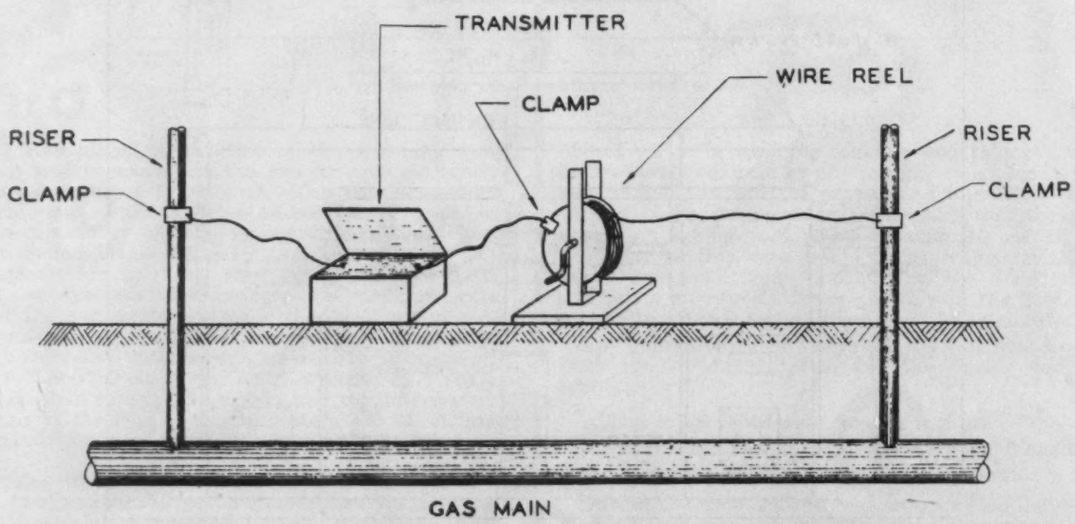


FIG. 1. Method of connecting reel and transmitter to an underground pipe.

brating coil. Power is provided by six No. 6 dry cells connected in multiple series. With fresh batteries, this gives about five volts input. For lack of instruments, the low efficiency of this transmitter was not measured by simultaneous measurement of input and output power. However, it can be sensed from the high battery drain of between 2 and 2.5 amperes with the vibrator adjusted as in normal ignition use and the transmitter unloaded. With the output fully loaded the battery drain increases approximately 0.5 to 0.8 amperes. The no-load current drain of the two-coil transmitter can be reduced by altering the upper vibrator spring as suggested in the following discussion on single-coil transmitter.

Fig. 4A shows the circuit of a successful single coil transmitter. The output is taken across the primary winding of the coil and the secondary left open. So far, no trouble has been experienced from the secondary breaking down due to its being left open.

With six volts input furnished by four 3-volt batteries connected in multiple series, the no-load current drain of the coil can be reduced to about 0.6 ampere by rigidly attaching the upper vibrator spring contact to its carrier as shown in Fig. 4B. This change also increases the vibrator frequency. The output current of this transmitter comes directly from the batteries when the vibrator contacts are

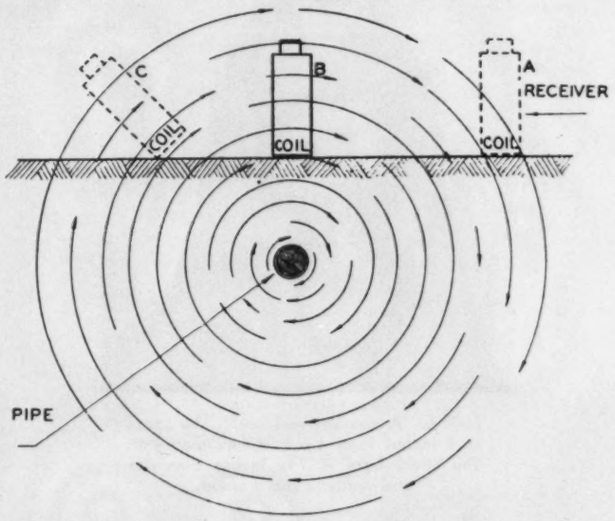


FIG. 2. Illustrating the use of the receiver for determining the position of a pipe.

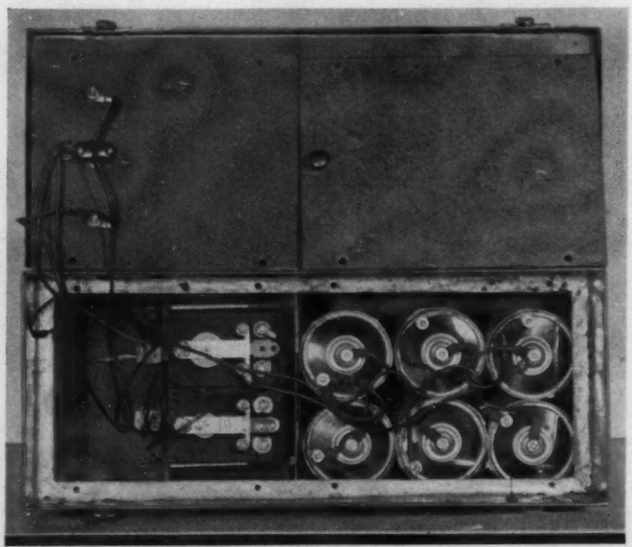


FIG. 3A. Internal view of a two coil fransmitter. The case is 9 inches deep by 6 inches wide by 14 inches long. Weight is 27 pounds.

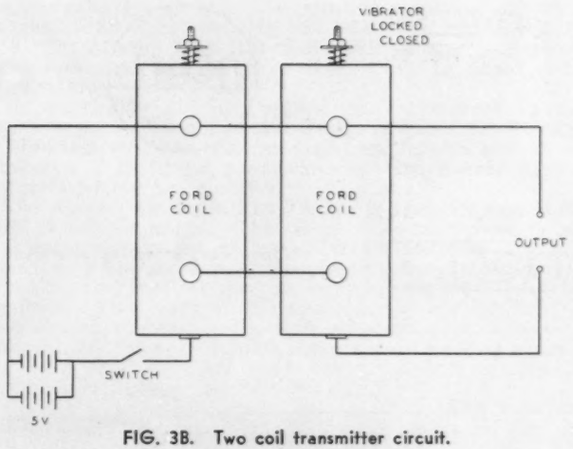


FIG. 3B. Two coil transmitter circuit.

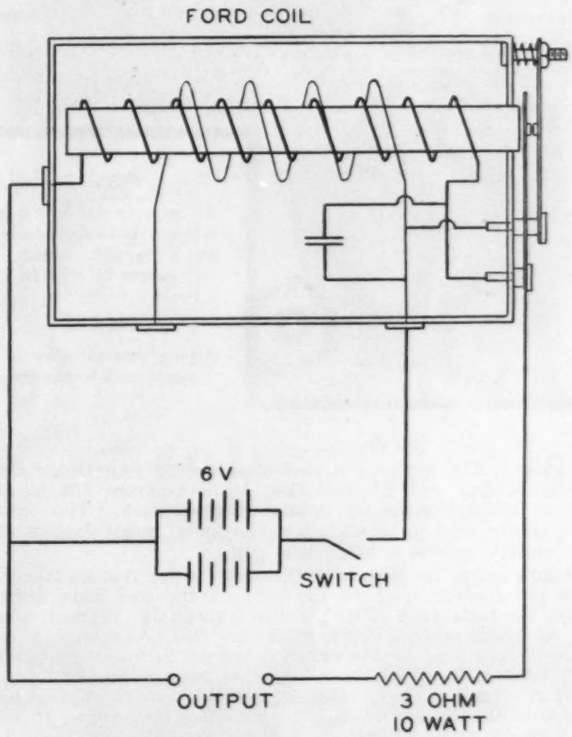


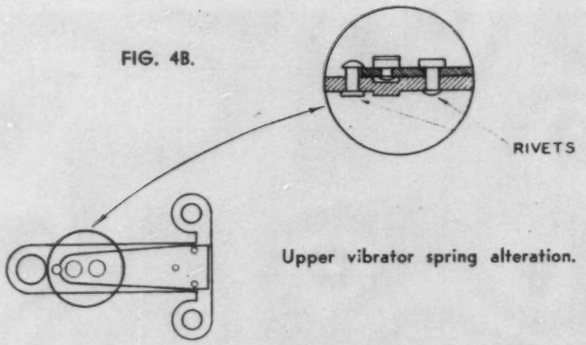
FIG. 4A. Single coil transmitter circuit.

closed and from the charge in the primary coil when the vibrator is open. The input current increases with the load. For this reason, a 3-ohm resistor is placed in series with the output to prevent sticking of the vibrator at full load, a condition that rarely occurs, because the transmitter is nearly always connected through several hundred feet of reel wire. A practical comparative test of a two-coil and a single-coil transmitter was made by connecting each transmitter to a 100-ft. square loop of wire and measuring the signal strength with an output meter in a receiver 12 ft. away from one side of the loop. With the transmitters adjusted to produce the same receiver output, the two-coil transmitter was drawing 2.8 amperes from the batteries and the single coil transmitter was drawing only 1.2 amperes. Fig. 4C and 4D are photographs of a single-coil transmitter.

Reels

Mechanically, there is not much to be said about the reels. The principal requirements are that the reel be strong enough to stand the abuse it gets in the field and that some means be provided to prevent the wire from

FIG. 4B.



Upper vibrator spring alteration.

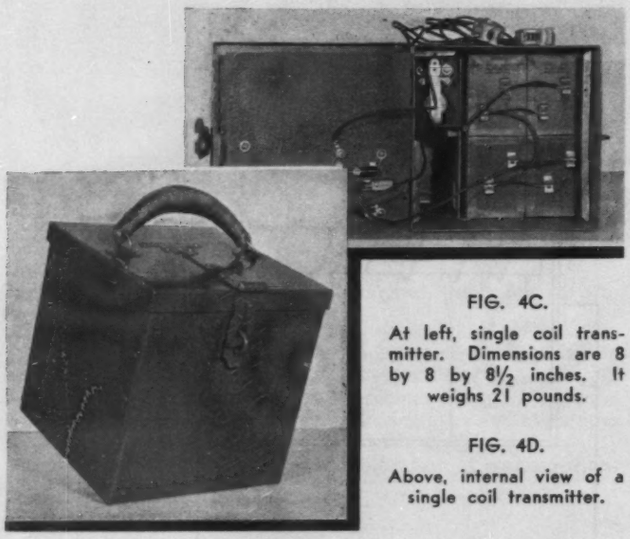


FIG. 4C.

At left, single coil transmitter. Dimensions are 8 by 8 by 8½ inches. It weighs 21 pounds.

FIG. 4D.

Above, internal view of a single coil transmitter.

tangling. Fig. 5 shows a reel used by the San Diego Consolidated Gas and Electric Co. It holds from 500 to 800 ft. of 18-gage stranded rubber-covered wire. The inside end of the wire is connected to the metal spool flanges and the outside end to a large test clip.

Electrically, the effect of the reel in the transmitter circuit is important. If all the wire on the reel were always used, the resistance offered to the transmitter current would be relatively unimportant, since the D.C. resistance of the wire is only four or five ohms; however, in many cases only 100 or 200 ft. of wire are required to complete the transmitter circuit. Under these conditions, most of the wire remains on the spool and the resulting inductance is high enough to impede the flow of the transmitter current. The reel impedance varies with the amount of wire on the spool and the transmitter frequency. A fully wound wood core reel of between 600 and 800 ft. of wire will show an impedance in excess of 100 ohms at ordinary transmitter frequencies.

One way to cancel completely the reel impedance is to connect the transmitter to a tap on the wire, so that the current does not pass through the whole reel winding; this scheme is objectionable because it requires taps or bare spots along the wire at short intervals which may ground out the transmitter current at some undesired point. Another way of avoiding this difficulty, although not so effective as the one just mentioned, is to wind two layers of 16-gage D.C.E. wire on the reel spool and connect the ends together.

A test of the effectiveness of this method was made by constructing a 600-ft. reel so that the two-layer winding could be opened or closed. Four hundred ft. of wire were then let out to form a 100-ft. sq. loop. This left 200 ft. still on the reel. An output meter in a receiver 12 ft. away from one side of the loop indicated that closing the two-layer winding approximately doubled the signal strength.

Fig. 6A and 6B show a combined transmitter and reel. The transmitter is of the single-coil type, and the reel makes use of the impedance compensation winding just discussed.

Receivers

The earliest type of receiver employed only a pick-up coil wound on a bicycle wheel or other suitable form and a pair of headphones. Unless the transmitter current was exceptionally strong, the receiver signal was weak and could be heard only a short distance away from the pipe.

Conventional receivers of today use smaller pick-up coils and audio frequency amplifiers to increase the signal strength before reaching the earphones. Fig. 7A is a picture of such a receiver. The pick-up coil is placed in the bottom of the case. It consists of 500 turns of No. 30 S.C.E. wire wound on a rectangular form 4 x 5 x ½ in. thick. The amplifier circuit is shown in Fig. 8A.

The principal requirements of a pipe locator amplifier are that it provide as much gain as possible, that it be small and rugged, and that the current drain be low enough to permit a reasonably long battery life. Wide linear range frequency response is of no importance. With the array of vacuum tubes and other necessary equipment on the market today, these requirements can be fulfilled by an almost limitless number of suitable designs.

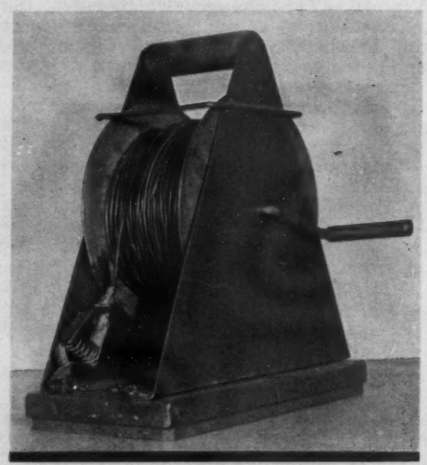


FIG. 5. A conventional reel. The spool is 4 inches long by 8 inches diameter. The spool core is 1¾ inches diameter and made of hard wood.

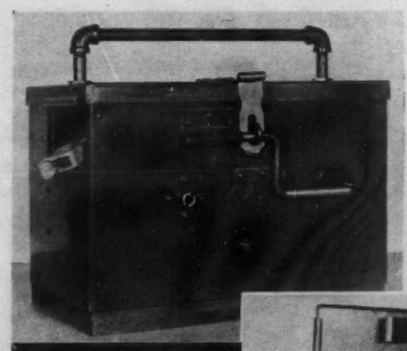


FIG. 6A.

At left, combined transmitter and reel. It weighs 35 pounds. The case dimensions are 8½ inches deep by 8 inches wide by 13½ inches long.

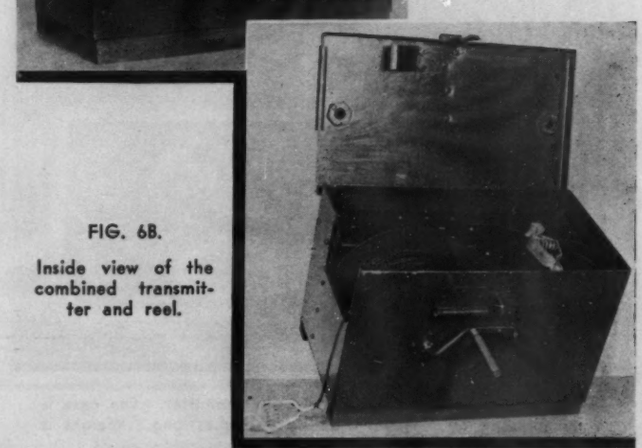


FIG. 6B.

Inside view of the combined transmitter and reel.

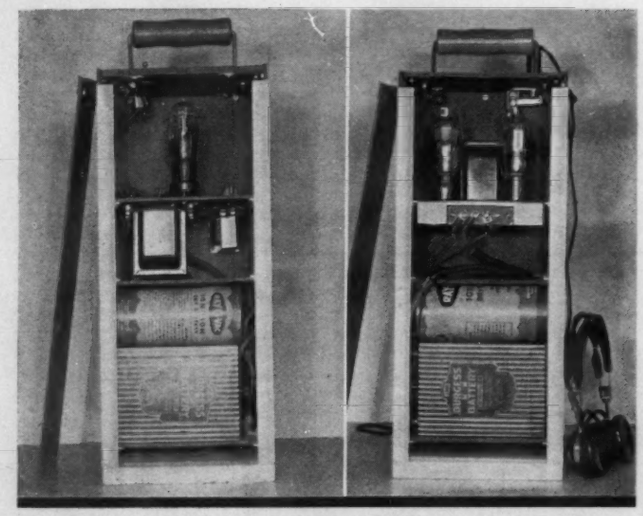


FIG. 7A. At left, two stage transformer coupled receiver. The second tube is directly behind the first one. This receiver weighs 22 pounds. It is 7¾ inches wide by 5¾ inches deep by 18 inches high. FIG. 7B. At right, receiver which uses the amplifier circuit of Fig. 8B.

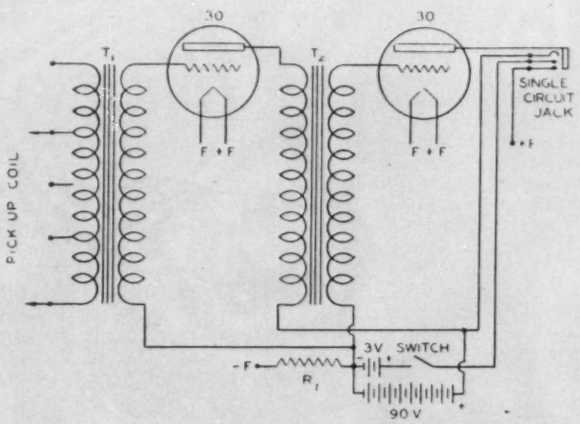


FIG. 8A. Two-stage transformer coupled amplifier circuit. R_1 may be an 8 or 10 ohm, 10 watt resistor.

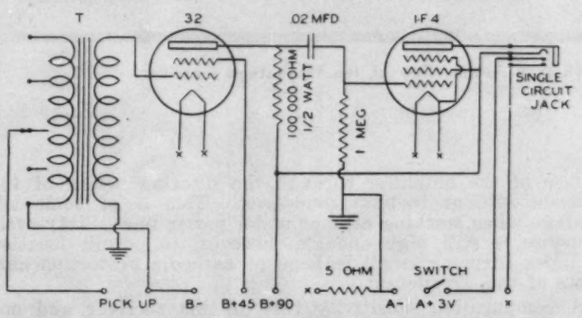


FIG. 8B. Two-stage resistance-capacity coupled amplifier used in the receiver shown in Fig. 7B.

The circuit shown in Fig. 8A will be recognized as that of a simple two-stage transformer coupled amplifier. The transformer, T_1, is a microphone-to-grid type with the primary tapped to permit matching various input impedances. T_2 is an interstage transformer of 3:1 to 6:1 ratio. The single circuit jack is used to cement a pair of 2000-ohm headphones in the plate circuit of the final tube and also to complete the filament circuit. No. 30 tubes are used in this amplifier. The grid circuits of both tubes are returned to the minus side of the "A" battery. Although these tubes are designed for greater bias than this method furnishes, no increase in signal strength will be noticed by the addition of a "C" battery. The fact that too little bias is employed does, however, increase the plate drain to about seven milliamperes.

No particular difficulty should be experienced in constructing an amplifier like that shown in Fig. 8A. The gain is comparatively low, and no feed-back trouble will be encountered if the usual precautions of transformer position and grid wiring are observed.

The receiver shown in Fig. 7A has a masonite case bound with aluminum angle. This form of construction is mechanically strong, but unless all frame members are well-joined, or well-separated, clicks and scratching noises will be heard in the receiver due to intermittent contact of the members. That part of the metal frame surrounding the base should preferably be made discontinuous, because if made in the form of a solid ring, it acts both as a shield and as a short-circuited single-turn secondary around the pickup coil.

Another receiver is shown in Fig. 7B. The case and pick-up coil of this receiver are the same as in Fig. 7A, but the amplifier circuit is that shown in Fig. 8B. This kind of amplifier is commonly known as a resistance capacity coupled type. It makes use of tubes with high amplification factors, and the overall gain is at least twice

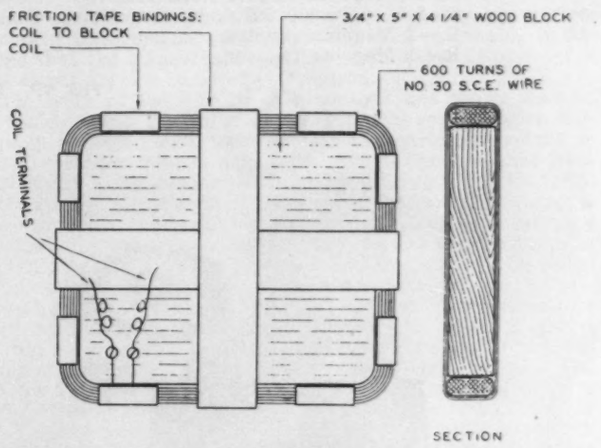


FIG. 9C. Details of the pick-up coil used in the three-stage receiver of Fig. 9A.

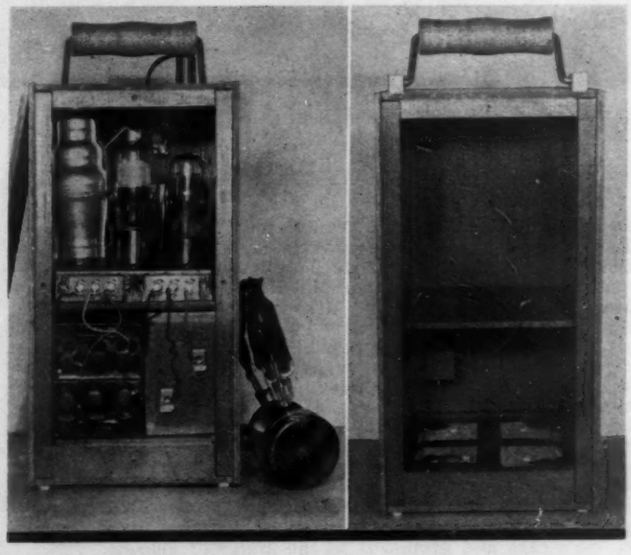
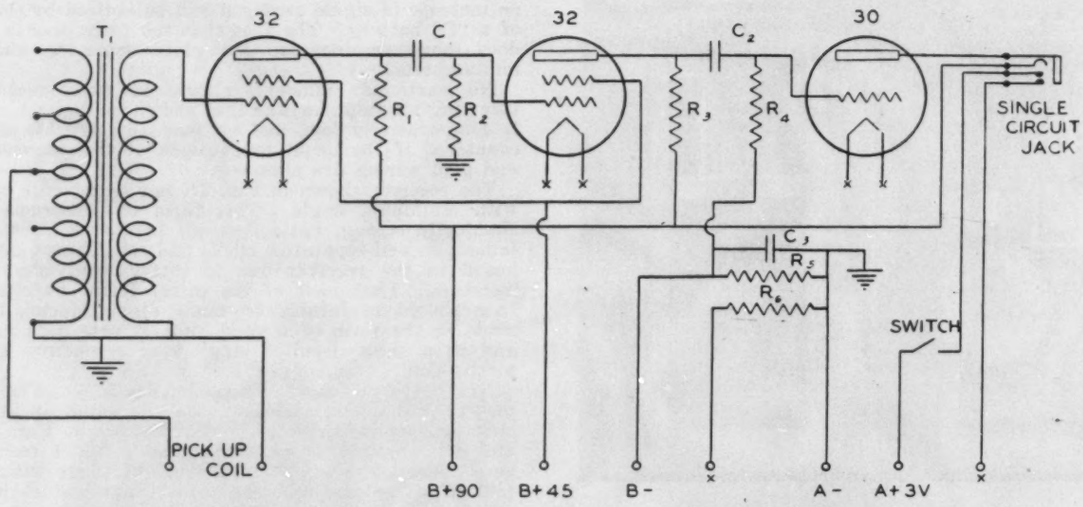


Fig. 9A. (Left) Receiver using three stages of amplification. The case is made of Masonite and wood. Its outside dimensions are 7¼ by 6½ by 12¼ inches. The receiver weighs 14¾ pounds. FIG. 9B. (Right) Inside view of the three-stage receiver case. The pick-up coil is shown in the bottom.



T_1—Microphone-to-grid transformer.
R_1 & R_2—100,000 OHM, ½ watt resistors.
R_3—2 Megohm resistor.
R_4—1 Megohm resistor.
R_5—1,000 OHM, 1 watt resistor.
R_6—5 OHM, 10 watt resistor.
C_1 & C_2—.02 MFD, 250 volt condensers .
C_3—10 MFD, 35 volt electrolytic condenser.

FIG. 9D. Three-stage amplifier.

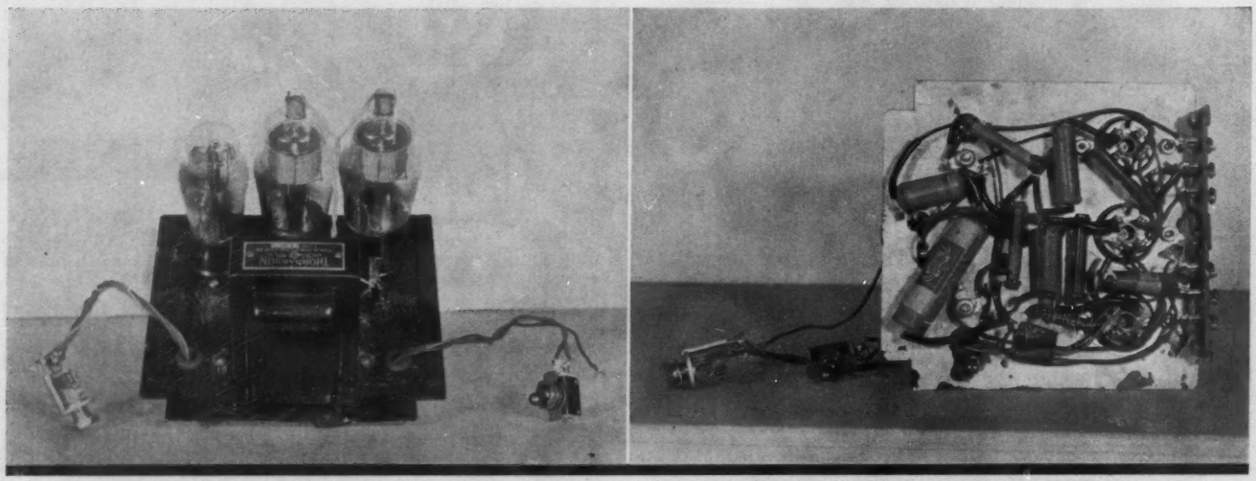


FIG. 9E. (Left) Three-stage amplifier. Top view. FIG. 9F. (Right) Bottom view of the three-stage amplifier.

as great as the two-stage transformer coupled amplifier of Fig. 8A. The "A" battery drain is 180 milliamperes and the "B" battery drain about 9 milliamperes.

A receiver that is smaller and lighter than either of the two previously mentioned, although it contains a 3-stage high gain amplifier, is shown in Fig. 9A. Weight and size reductions are made possible by compact amplifier design and the use of smaller batteries. A general idea of the case construction is indicated by Fig. 9B. Details of the pick-up coil are shown in Fig. 9C. The amplifier is constructed as a separate unit that may be quickly and easily removed from the case. Figs. 9D, 9E, and 9F respectively show the circuit diagram and top and bottom views of the complete unit. Although not always necessary, it is advisable to use a shield around the first No. 32 tube and also mount a small metal plate in the top of the receiver's case and ground it to the amplifier chassis.

In the circuit diagram of Fig. 9D, it will be noticed that the last tube is cathode biased. The amplifier will work if this biasing arrangement is not incorporated. The main reasons for its use are that it lowers the "B" battery drain and at the same time tends to attenuate the 60-cycle response of the amplifier through the filtering action of the cathode resistor by-pass condenser. This is of some advantage when working near or under power lines. Sixty-cycle response is still high enough, however, to permit location of pipes carrying small leakage or cathodic protection currents of this frequency.

A comparative sensitivity test of this receiver and one using two stages of transformer-coupled amplification was made by determining how far the signal could be heard from a 100-foot square loop of wire energized by a conventional transmitter and located in an area when there was no outside electrical interference. The same pair of headphones was used with both receivers, and the signal fade-out point judged by ear. The signal in the two-stage receiver faded out 310 ft. away from the loop and in the three-stage receiver, 500 ft. away. Assuming that the signal strength varied as the square of the distance from the loop, these results indicate that the three-stage receiver is about two and one-half times as sensitive to weak signals as the two-stage receiver.

When using headphones in conjunction with 3-stage receivers, it will, in most cases, be found unnecessary to wear

the headphones directly over the ears. This is of some help in reducing the hazards of locating pipes in streets where automobile traffic is heavy. A 3-in. permanent magnet speaker mounted inside the receiver case has been tried with one of these units. The volume is sufficient for ordinary operation, but could be increased by substituting a tube with a higher power rating in the last stage of the amplifier.

Pipe locaters have become standard equipment with most utilities, and we are using 19 of these instruments at the present time. The saving of time and labor effected by their use is so great that they are considered an essential item of equipment on each gas main and service crew. Most of these locaters are the two-stage type. They were developed before the improvements mentioned in this paper were made and are entirely satisfactory for most purposes. However, any further requirements for such instruments probably will be filled with three-stage receivers using a small 3-in. speaker instead of the less-convenient headphones.

The successful operation of pipe locaters depends a great deal upon the skill and experience of the operater, the type of soil, the electrical continuity of the pipe, and the condition of the pipe coating, but under ordinary conditions they can be relied on to tell the story.

We have tried pipe locaters of the "treasure seeker" type using reflected radio frequency waves and under certain conditions they are satisfactory, but they do not possess the all-round utility of our present instruments.

Summary

Reels employing impedance compensating windings are desirable because they offer less resistance to the transmitter circuit when all the wire is not unreeled.

Transmitters with one coil are an improvement over the two-coil type because of greater electrical efficiency.

Three-stage receivers are unquestionably better than two-stage receivers because they are more sensitive to weak signals. A three-stage instrument may succeed where the two-stage type fails.

A Method for Direct Determination of Soil Corrosivity in Terms of Conductivity

By M. T. BURTON

Southern California Gas Company

DURING the past two decades the problem of soil corrosion has become increasingly important as is evidenced by the large and steadily growing literature on the subject. Governmental and private agencies such as the National Bureau of Standards, the American Petroleum Institute, and the American Gas Association have contributed an immense amount of data from studies covering both the fundamental causes of corrosion, and methods and materials for corrosion mitigation.

The intelligent and economic application of protective coatings or other protective measures to underground structures requires some method of evaluating the probable corrosion hazard in soils. Numerous attempts have been made to so evaluate the "corrosivity of soils" by many different methods. Apparently, complete chemical analyses of soils would offer the most logical method, but it is a matter of record that the correlation of such analytical data with known "corrosivity" has not been satisfactory. (Bibliography, 1 and 2.)

Soil corrosion is generally accepted as being an electrochemical phenomenon and, therefore, it is reasonable to assume that the measurement of the electrical properties of a soil might form a basis of comparison.

The work of the Bureau of Standards has shown that a corrosive soil is generally low in electrical resistance or conversely of high conductivity, this being particularly true in alkaline rather than in acid soils. These findings have been corroborated by numerous investigators so that electrical conductivity is rather good measure of the relative corrosiveness of soils. Several methods of soil testing measuring conductivity have been devised and used with considerable success, among them the Shepard Rod test and the so-called "Nipple and Can" test or "loss-in-weight" method. (Bibliography, 3, 4 and 5.) The latter test has been extensively used in Southern California; some 25,000 determinations having been made. This method measures indirectly the average conductivity of a soil over a 24-hour period. The results are determined as "anodic" loss weight at a definite D.C. potential and are reported as "Corrosion Index." While the "loss-in-weight" method has the advantage of simplicity and low initial cost of equipment, there are inherent errors due to polarization effects as in any electrolytic conductivity

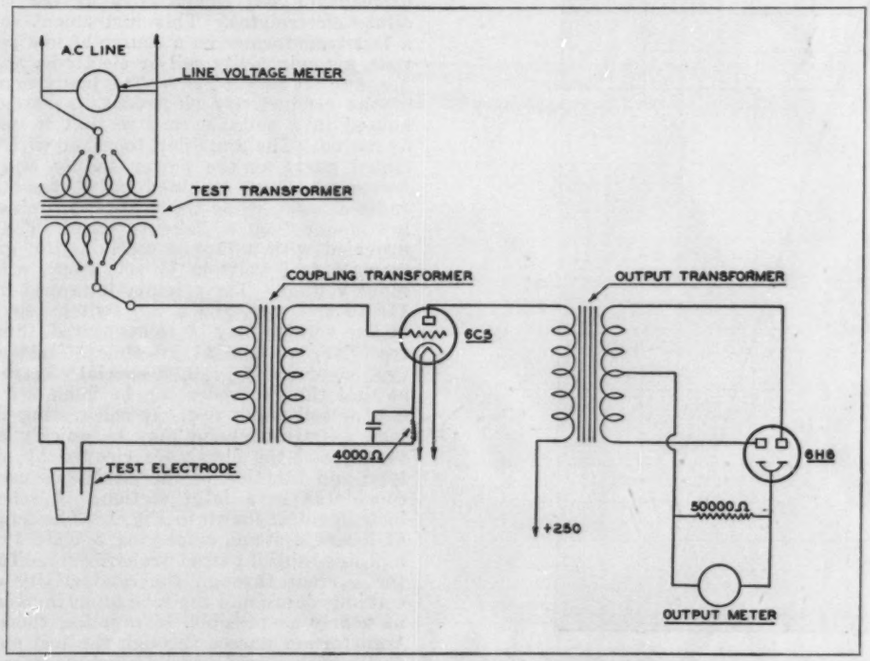


FIG. 1. Schematic circuit of soil conductivity meter.

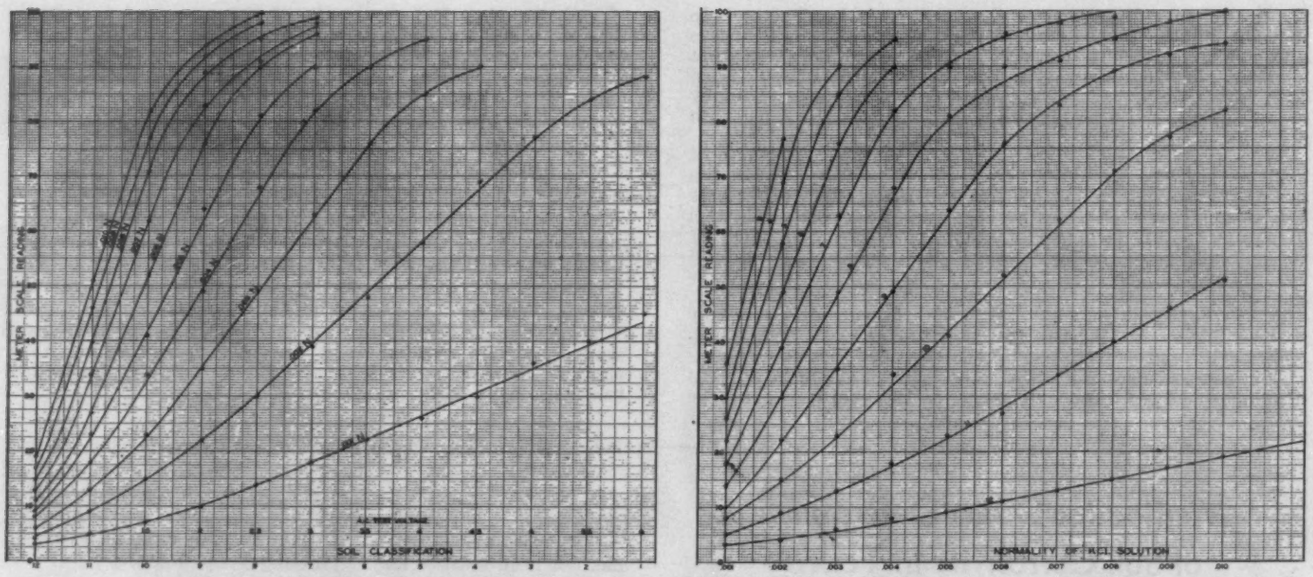


FIG. 2A (left) and FIG. 2B (right) show the calibration of soil conductivity meter with pure solutions of KCl at 85° F.

measurement made with direct current. Polarization effects are, however, somewhat minimized by an average measurement over a long time interval. Too, there may be a considerable personal error due to the large number of operations required for each test. The most important disadvantages are, however, the cost of labor and material and the time required to make a determination. Any other method of testing which would give equally satisfactory or superior results and greatly reduce the cost and time would be of real value to the Industry.

The purpose of the present paper is to present a new method for the direct measurement of conductivity which combines both accuracy and rapidity.

The conventional method for the determination of electrolytic conductivity employs an alternating current bridge,

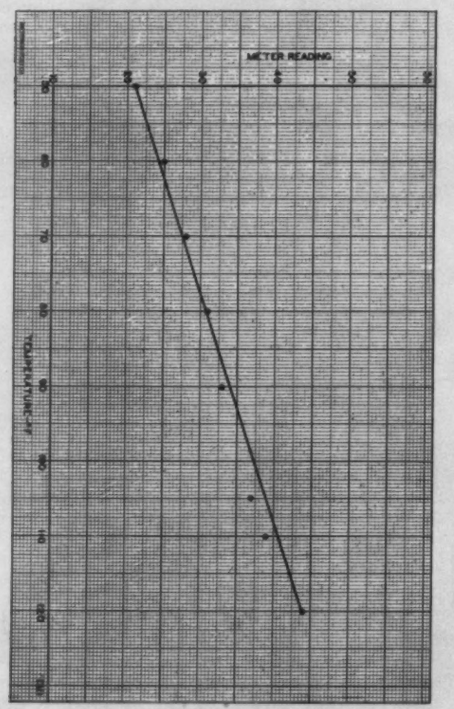


FIG. 3. Effect of temperature on conductivity with soil conductivity meter. (.004 normal KCl—soil classification No. 10).

using an A.C. frequency of 1,000 cycles or more. In the hands of a skilled operator, this method gives precise results but it is not generally suitable for routine work such as soil testing.

With the use of alternating current of 50 or 60 cycles, polarization effects are greatly minimized over those of D.C. and the measurement of conductivity with such commercial frequency should be highly satisfactory for such work as soil testing. Theoretically, it should be possible to measure the current through a suitable conductivity cell by means of an A.C. meter in series with the cell and the source of current. Practically, such measurement is difficult due to the relatively large operating current drawn by A.C. meters. The most logical method then, is to amplify the minute current of the conductivity cell to a sufficient magnitude and then rectify the amplified A.C. so that the amplified current or voltage may be read on a sensitive D. C. meter. An instrument based on this method has been developed whereby A.C. of commercial frequency is utilized for the direct measurement of soil conductivity or the conductivity of other dilute electrolytes. This instrument consists essentially of a test transformer as a source of low potential working current, a conductivity cell or electrode, an amplifier and rectifier, and an output meter. The instrument, with the exception of the conductivity electrodes, is assembled as a unit and housed in a suitable case so that it may be easily handled or moved. The amplifier, together with such necessary associated parts as the power supply and filter, and the test transformer are mounted on a standard 7½x12 in. metal radio chassis, while the meters, switches, and other controls, are mounted on a Bakelite panel. The test transformer is provided with a tapped secondary to give exact voltages of from ½ to 6 volts in ½ volt steps, with a definite primary input voltage. The primary is tapped in two-volt steps from 110 to 130 volts and a tap switch provided so that changes in line voltage may be compensated, thus giving the specified secondary voltage at all times. Instead of a conventional type conductivity cell, a special electrode assembly is used, so that the electrodes can be immersed directly in the solution or soil under test. In soil testing this is a great advantage as measurement may be quickly made in any suitable vessel, and the electrodes cleaned by simple washing. The type and function of the electrodes used will be more fully considered in a later section. A schematic sketch of the instrument is shown in Fig. 1. The amplifier proper consists of a single stage, employing a 6 C 5 type tube, feeding into a center tapped output transformer. To successfully amplify the current through the conductivity cell or electrode, the cell impedance and the tube input impedance must be matched as nearly as possible. In practice, the current from the test transformer passes through the test electrodes which are in series with a grid coupling transformer having an impedance at 60 cycles of approximately 15 ohms. The secondary im-

pedance is approximately 7,500 ohms which serves to effectively couple the cell circuit to the grid input circuit. Self-bias is used on the tube and 250 volts D.C. obtained from the power pack is supplied to the plate. The output transformer is a standard push-pull input type (plate to two grids) with a ratio of 1.5 to 1. The usual grid leads are connected to the plates of a 6 H 6 Duplex Diode tube acting as a full wave rectifier. The cathodes of the tube are connected together and a load resistor of 50,000 ohms placed between the cathode and center tap of the output transformer. A volt meter of 10,000 ohms per volt sensitivity of 100 volts full scale range is placed in parallel to the load resistor, the cathode end being positive and the center tap end, negative. Thus, the output voltages developed across the load resistor are read on a highly sensitive D.C. meter which draws a minimum of current and does not disturb circuit conditions. The power pack consists of a conventional full wave tube rectifier and a "pi" type filter system, using high quality paper-wound condensers and a 30 henry choke. The requirements for such a filter system are very rigid as it is necessary that ripple voltage be kept as low as possible. Any ripple voltage will be amplified and will appear on the output meter as a residual reading, introducing a very troublesome error. The excellence of the filter used is shown by the fact that the residual reading on the output meter is approximately ½ of one per cent of scale.

Several types of electrodes have been used. The original electrodes were ½ in. lengths of No. 20 gage platinum wire, sealed in glass and spaced rigidly one inch apart. Results with the original platinum electrodes were excellent, but we were unable to produce satisfactory duplicate electrodes, although they were made from the same piece of platinum wire and were of exactly the same size. These electrodes with the exception of the first, all exhibited a curious drifting of the electrode solution resistance, resulting in a very erratic behavior with attendant large errors in reading. An example of this action may be of interest:

In any given solution a reading at some low input voltage could rarely be duplicated if the input voltage were to be increased for a brief period and returned to the original settings. The output meter reading was always higher; occasionally, as much as 10 to 15 per cent of scale. This action is undoubtedly due to polarization effects and may be attributed to the adsorption of a film of gas or ions on the electrodes. The application of the higher voltage causes the disruption of the film, resulting in a lower electrode solution resistance. The same results could be produced by washing the electrodes in strong nitric acid, indicating oxidation of a hydrogen film. A stable electrode system was a necessity if satisfactory results were to be obtained and several other electrode systems were tried. Finally, a platinum, tungsten bi-metallic electrode, described by Furman and Wilson, was tried (Bibliography, 6.) This system is essentially self-polarizing and offers a practically constant electrode solution resistance. The platinum electrode of the assembly is ½ in. of No. 20 gage wire while the Tungsten is .040 by ½ inches. The electrodes are sealed in glass and are rigidly spaced ½ in. apart. This type of electrode has proven very satisfactory as it exhibits the effect described to only a very slight degree, recovering almost instantaneously and gives constantly reproducible results.

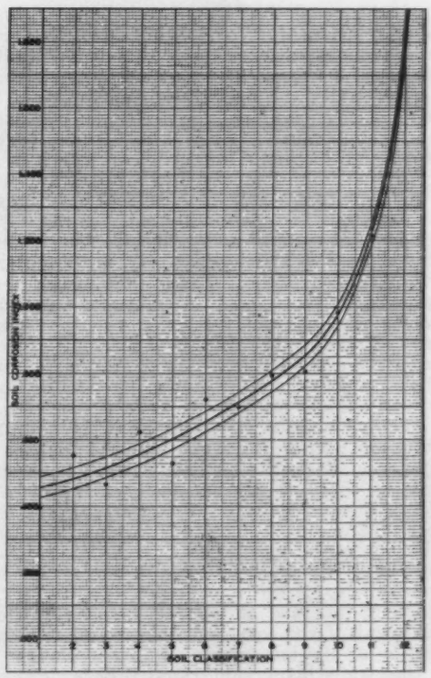


FIG. 4A. Correlation of soil conductivity meter with corrosion index by nipple and can method.

Pure dilute solutions of potassium chloride were used to determine the ability of the instrument to accurately determine conductivity or salt concentration. Curves showing the results obtained are given in Figs. 2A and 2B. These curves are characteristic of vacuum tube amplifiers, having a long linear portion with curved portions at the upper and lower

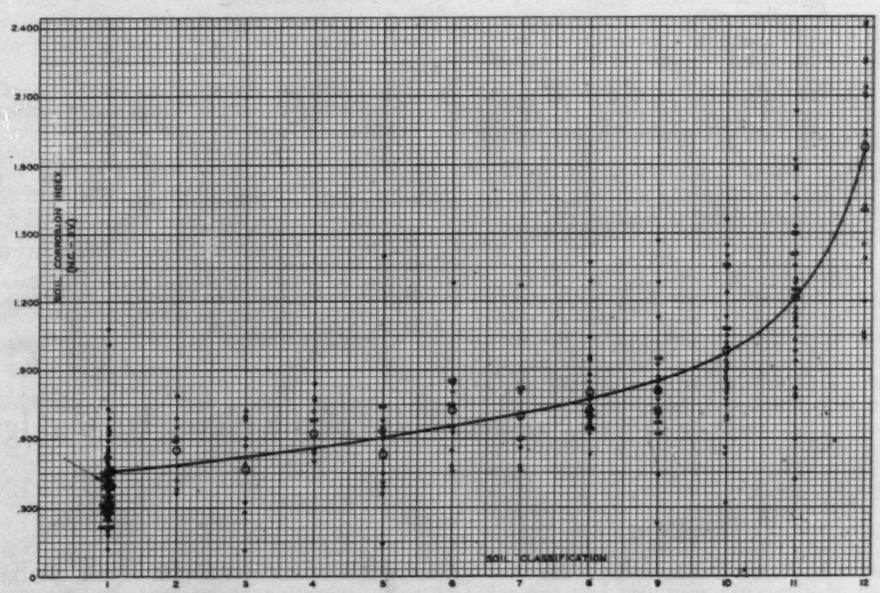


FIG. 4B. Correlation of soil conductivity meter with corrosion index by nipple and can method.

limits. It will be noted that by proper choice of input voltage, a linear relationship may be obtained for practically any range of concentration within the range limit of the instrument. Fig. 3 shows the effect of temperature on the indicated conductivity. These three curves show that the instrument gives consistent results which are sufficiently precise for most commercial work and that ordinary temperature variations will but little impair the accuracy of reading. The linear portion of the curves lies between approximately 20 and 80 on the output meter scale so that only that portion of the curve between these points is used.

To simplify the testing and classification of soils, the instrument was used in a somewhat different manner than in the work with salt solutions. The output meter is operated as a galvanometer, that is, all readings are referred to a constant meter reading and the input voltage necessary to give that meter reading is taken as a measure of conductivity or corrosivity classification. As a reading of 50 on the meter scale is midway on the linear portion of the curve, this point was chosen as the reference point. In cases of very mild soils, of course, the meter reading may fall much lower on the scale than 50, even with the highest possible voltage input, i.e., Classification No. 1. This, however, causes no difficulty as the soil will naturally fall in the mildest classification. Some 240 soils were tested in this manner, the Nipple and Can Corrosion Index having been previously determined by another operator. Correlation of the results obtained by these two methods of soil testing are shown in Figs. 4A and 4B.

The author is indebted to Mr. P. Levin for the mathematical treatment of the correlation data and for the following explanation of the treatment:

Due to the wide dispersion of the data, a method of grouping was devised so that the soil corrosion index by the Nipple and Can method, and soil classification by the soil conductivity meter, could be correlated. This method consisted of taking the average of all the soil corrosion indices that lay in soil classification one and plotting the average soil index thus obtained against the Number One soil classification. In this manner, the average soil index for each soil classification from one to 12 was determined and plotted on co-ordinate, semi-log, and log-log paper.

As none of these three plots tended toward a straight line and the necessity for obtaining an equation was not deemed necessary, three smooth curves were drawn on graph paper that best represented the plotted points with the soil classification plotted as the abscissa or "x" component and the soil corrosion index plotted as the ordinate or "y" component. From these three curves an average curve for the points was drawn. From this average "free hand" curve the standard deviation, index of determination, index of correlation, and probable error were calculated.

The standard deviation was calculated from the formula:

$$O_z = \sqrt{\frac{\Sigma (z)^2 - n (M_z)^2}{n}}$$

in which "z" is equal to the "y" value of a plotted point, minus the "y" value as obtained from the curve Mz is the mean of the "z" values, and "n" is the number of plotted points.

In order to calculate the index of determination, the standard deviation of "y" was calculated in the same manner as for "z." The index of determination is calculated from:

$$(\overline{P}xy)^2 = 1 - \frac{(O_z)^2}{(O_y)^2} \times \frac{(n-1)}{(n-m)}$$

in which $(\overline{P}xy)^2$ is the index of determination and "m" is the number of constants in the equation of the curve. Assuming that the number of constants in an equation of the curve to be two, the index of determination is equal to .983 or 98.3 per cent. Thus, according to the curve as drawn, 98 per cent of the variation in soil corrosion index is attributable to soil classification. The index of correlation is equal to the square root of the index of determination or .992.

The probable error of the average points was calculated as .032 from the equation in which probable error is equal to a constant, used in probability calculations, of .6745 times "Oz." This probable error is the probable error of the average of a large number of observations under any one soil classification and does not hold for a single observation.

The foregoing results demonstrate the accuracy of the method and the instrument for the determination of the electrolytic conductivity of soils or the concentration of dilute electrolytes such as boiler waters.

The chief advantage of this method over the "loss-in-weight" method is the extreme simplicity and rapidity of determination with the attendant large saving in cost of operation. With the new method, the troublesome and costly preparation of test anodes is completely eliminated. This means that the cost of pipe for anodes, the cutting, numbering, sandblasting, weighing, etc., are eliminated. Further, the total elapsed time from the receipt of soil samples to the time of reporting is reduced from a minimum of 30 hours to a few minutes. We estimate the total time for the "loss-in-weight" method to be approximately one man-hour per sample, including preparation of anodes, cleaning, etc. With the new method, two men in four hours' time easily made 140 separate and complete determinations, or approximately 3½ minutes per sample was necessary. In actual practice, the procedure is as follows:

The samples are received in one quart vacuum top cans with a tag giving full particulars as to location, etc. The samples are given serial numbers by means of a numbering machine while still attached to the sample container, eliminating confusion of samples.

For test containers, small one-piece waxed paper cups have proven very satisfactory. The number of the soil samples may be written with pencil on the cup for identification during test and the cup discarded after the test is completed, eliminating washing or breakage of beakers or other glass vessels. As these cups cost approximately $1.80 per 1,000, the cost per determination is far less than the labor of washing glass containers. A portion of the soil is transferred to the cup and aerated distilled water added until the soil is just visibly saturated as in the "loss-in-weight" method. After thorough stirring with a glass rod, the test electrode is completely immersed in the soil, so that it does not touch the walls of the container at any point. Adjustment of the input voltage switch, which is numbered from one to 12, is made until the scale reading nearest to 50 is obtained. This is taken directly as the soil classification, the least corrosive soil being one on the scale and most corrosive 12.

The results are then reported directly as soil classification or may be transposed to soil index by the curve of Fig. No. 4A. It is obvious, of course, from the curve of Fig. No. 4A that all soils having corrosion indices (Nipple and Can) of over 1,200 will lie within Class 12. However, as all soils over this value are very corrosive and require maximum protection, their grouping in Class 12 will cause no confusion.

Summary

1. A new method and an instrument for the direct laboratory determination of soil corrosivity in terms of conductivity has been developed.

2. Accurate, reproducible, and dependable results are obtainable at a saving in labor costs of approximately 90 per cent.

3. The total elapsed time from receipt of samples to time of reporting is reduced from a minimum of 30 hours to a few minutes.

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Use of the Neon Tube in Ignition Timing

By GROVE LAWRENCE

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THE IMPORTANCE of accurate ignition timing in the operation of internal combustion engines is generally well recognized. Its effect upon the types of large, slow-speed units in gas compression service was covered in a

paper which was presented before this Association several years ago.†

By way of brief review, a set of power cylinder indicator cards from a 160 hp. 18x20-in. gas engine are shown in Fig. 1. Card No. 1 was taken with all adjustments, such as valve and ignition timing, air-fuel ratio, etc.; at the best possible setting. Card No. 3 was taken after the ignition had been advanced 10° ahead of the best position, with all other adjustments remaining undisturbed. The result was a loss of power with an increase in peak pressure. Card No. 4, taken with the ignition timing set 10° later than the best position, also showed a loss of power. The condition shown by Card No. 2 will be discussed later.

In casting about for a practical means of checking ignition timing under operating conditions, it was found that a form of stroboscope had been developed for use in automotive work. This instrument is available commercially at a cost of about $5.00. It uses a small neon tube as a source of illumination, and can readily be adapted for use in checking stationary gas engines.

The term "stroboscope," as used herein, is intended to mean an instrument which gives the visual effect of stopping or retarding motion, by supplying a source of illumination which is interrupted in synchronism with the normal motion of the parts to be examined.

The Principle Illustrated

The diagram, Fig. 2, is intended to illustrate the principle of the device, and its application to the problem at hand. It consists of a small neon tube mounted between a reflector and a lens, and the whole arrangement resembles an ordinary pocket flashlight. A pair of rubber-insulated leads are provided, to connect the neon tube to the spark plug, and to ground.

It is characteristic of the neon tube that a small, hi-voltage current will cause the tube to emit an appreciable amount of light, and that the duration of the after-glow is very brief when the current is shut off. In our application, with the high tension wire from the spark plug as the only source of current, it is obvious that light will be emitted only at the instant that the spark occurs at the plug terminals.

Most engines are provided with a fixed pointer or reference mark near the face of the fly-wheel. To use the stroboscope, it is only necessary to paint a narrow stripe across the fly-wheel face in such a location that it will be opposite the reference pointer when the fly-wheel is in the position at which the spark is required to occur. Having the mark in the proper position, one lead from the stroboscope is clipped on a spark plug terminal, and the beam from the neon tube is directed to the face of the fly-wheel at a point opposite the reference point, or index. With the engine operating at full speed, if the magneto timing is correct, the fly-wheel stripe will appear in the field of illumination, directly opposite the reference point. It was found unnecessary to ground the second lead from the neon tube.

† Proceedings of the Pacific Coast Gas Association, Vol. 23 (1932), p. 301.

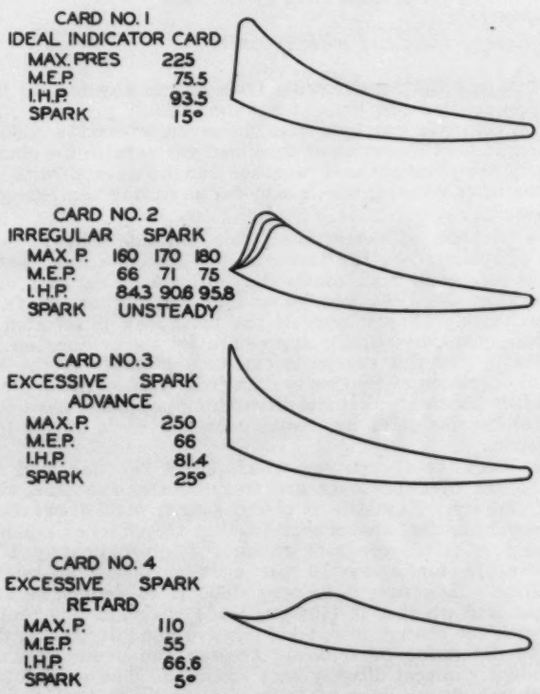

FIG. 1. Indicator cards showing effect of ignition timing.

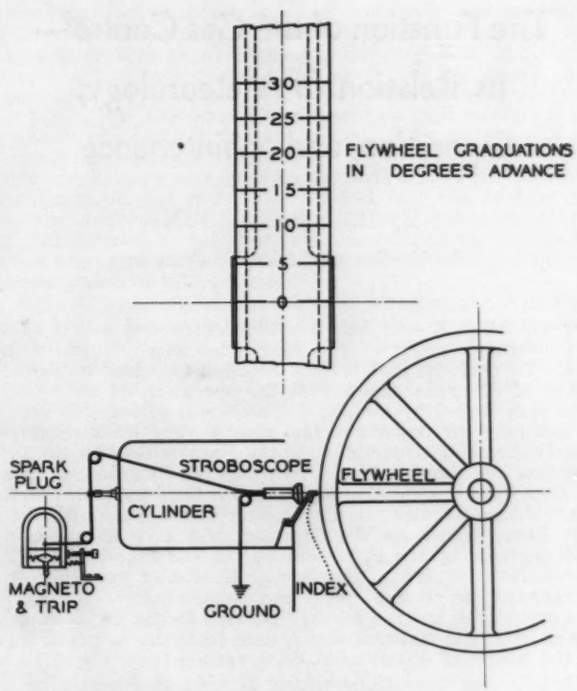

FIG. 2. Arrangement for using neon stroboscope for checking ignition timing.

Useful with Units Having Oscillating Magnetos

This device is most useful in the case of units having oscillating magnetos, which are likely to have an appreciable time lag between the instant the armature is tripped, and the instant the spark occurs at the plug points. This time lag varies for each magneto and tends to increase as the magneto trip springs become fatigued. With a practical means of checking timing with the engine running, it becomes desirable to provide a screw adjustment on the magneto brackets so that the "lead" can be changed from time to time to compensate for increasing lag.

An interesting sidelight on the use of this device appeared during some of our tests, and is illustrated by Card No. 2, Fig. 1.

The condition shown was caused by a badly worn magneto. While the defect can be detected readily by use of the indicator, it would not be caught by ordinary operating methods, such as try-cock tests. The application of the stroboscope immediately revealed that the magneto was so badly worn that the spark advance varied 5° from one revolution to the next. Replacement of the defective magneto produced the card shown as No. 1.

For experimental purposes, it is suggested that a series of lines one or more degrees apart be painted on the fly-wheel face, and numbered to correspond with degrees of fly-wheel rotation. With this arrangement, and a suitable adjusting device on the magneto bracket, the spark advance can be changed at will, and maintained with a satisfactory degree of accuracy.

The author gratefully acknowledges the assistance rendered by M. J. Binckley of the Southern California Gas Co., and members of his staff, in the development of this procedure.

The Function of the Gas Control— Its Relation to Meteorology, Operation, and Maintenance

By R. T. PETERSON

Pacific Gas and Electric Company

TO SERVE over half a million customers with a never-failing supply of gas fuel is no small responsibility. To perform that service requires the close cooperative effort of everyone engaged in the operation of the system. The part played by the gas dispatcher in giving this service is not only an important but also a very interesting job. The Dispatching department of the Natural Gas division, Pacific Gas and Electric Co., is known as the Gas Control. In addition to the Pacific Gas and Electric Co.'s system, the Gas Control also handles the dispatching of the Standard Pacific Gas lines, known as the Stanpac, which is jointly owned and operated by the P. G. and E. Co. and Standard Oil and Coast Natural Gas Companies. Generally speaking, this department is charged with the responsibility of directing the operations insofar as they pertain to the dispatching of the natural gas transmission system from the points of input to the points of distribution. (See system map, Fig. 1.)

Briefly, the operations which pertain to dispatching are any which will or may affect the following:

1. Production or delivery from the source of supply.
2. The flowing volume in the transmission lines.
3. The pressure in transmission lines.
4. Use of storage facilities.
5. Normal sendout such as curtailing or increasing the use to large industrial users of gas.
6. Regulation and control of the heat value of gas.
7. Use of compressing equipment at the field compressing station and the various gas plants throughout the system.
8. Estimating the requirements from hour to hour and for the succeeding day.

Of the foregoing, probably the most important and difficult problem to solve in connection with dispatching of gas is that of estimating the requirements. It is difficult to solve because the changes in load, with the exception of the industrial load, are dependent upon changes in weather. It is important for several reasons, the most important being:

1. In our case, a change of delivery at the field is not felt in San Francisco or Oakland for a period of one to several hours, depending upon the field at which the change is made.

2. The wells in the Kettleman Hills, from which we receive our major supply of gas, are producing gas and oil which, of course, are both very inflammable and produced at very high pressure. The wells are also very deep and costly to develop.

To reduce the danger involved in changing the production of wells the producing companies have established a rule which makes it necessary for us to plan our operations as much of the time as possible so as to avoid making changes at night and more than once in 24 hours. Pipe-line breaks, fires, and other such emergencies are, of course, exceptions to this rule. The gas companies realize the danger and fully appreciate the producers' problem; they cooperate in every way possible.

3. We have a storage holder capacity in San Francisco, Oakland, Stockton, Sacramento, and North Bay of approximately 63 million cu. ft. In addition, we have at times, storage available from excess pack in our transmission lines.

Without analysis, from this information it would seem that we have sufficient storage capacity to take care of almost any error that might be made in the estimate, but this is not always true.

1. We must keep sufficient gas in the storage holders at all times to take care of the load in the above mentioned cities for the maximum amount of time required for repairs in case of line breaks, blowouts, washouts, etc.

2. The total system average hourly load between 7 a.m. and 9 p.m. is greater than the average for 24 hours by 13.6 per cent. Therefore, if the delivery from the source of supply is set at a rate per hour equal to the average hourly demand for 24 hours and the lines are operating at continuous flow straight through, it will be necessary to draw from the holders between 7 a.m. and 9 p.m. an amount equal to 13.6 per cent of the total demand for the day. But if the lines were packed by regulation at the terminals, it would be necessary to draw from them an amount equal to 13.6 per cent of the total day's demand, less the amount available from the pack in the transmission lines.

This factor of 13.6 per cent is based on the total system load as it exists for the whole year and does not take into account the fluctuations brought on by the seasonal changes. For example, the factor for November to March is 16 per cent, for the period April to July is 12.2 per cent, and August to October is 11.6. The improvement in the factor for the period August to October is due to the heavy seasonal fruit canning and drying load and the beet sugar load.

Not only does this factor vary by season for the system as a whole, but it is also different for the various sections of our system. With the hourly load factor varying by seasons and for different sections of the system, it is necessary that the dispatching organization continually study the change in conditions and have a thorough knowledge of the load characteristics.

For these reasons it is not only important that the personnel have a thorough understanding of the system and load conditions, but that the estimates also be as accurate as possible.

Main Divisions of the Gas Load

The gas load of the P. G. and E.-Stanpac system is composed of three major groups: (1) Refinery, steam heat, and electric plant use; (2) surplus gas load (gas available to large customers); (3) firm load (consisting chiefly of service to domestic customers).

The requirements for the electric plants are determined by reports received from the Electric dispatcher's office as to the estimated kilowatt load to be carried at each individual plant. The requirements for the oil refineries are determined and furnished by the refineries.

Except for the seasonal changes, the surplus gas load does not change for corresponding days of each week, except by the addition of new customers or the intermittent operation of others. Nor is it affected by change in weather conditions, except for a small part of the load.

Variation of the Load with Weather

Estimating the requirements from day to day for the first two groups does not present a very difficult problem. The firm or domestic gas load does, however, present a difficult problem in that a portion of that load varies with the change in daily temperature and weather conditions and with the number of customers, which also varies during the changing seasons.

The problem of determining this variable load is made more complicated by the fact that five separate load centers are served, each load center having widely varying daily temperatures. When you know that 150 million cu. ft. or approximately 38 per cent of the total load is affected by weather, you can readily appreciate its importance on the gas load. For this reason it can be said that for the successful operation of the gas system from a dispatching standpoint it is necessary that the dispatching personnel have some general knowledge of meteorology insofar as it affects local conditions.

The elements of weather which affect the gas load and their order of importance are temperature, sunshine, wind and humidity. Humidity is placed fourth with reservations. The psychrometric charts indicate that the effect of humidity on comfort is an apparent change of approximately 1° in temperature for every 10 per cent variation in relative humidity. However, it is very difficult to determine from the gas load whether it (the gas load) varies in this proportion with the change in outside relative humidity. It is difficult to determine or separate because the humidity varies consistently almost directly with sunshine. The result of the studies which we have made to date indicate that for our purposes the effect of change in relative humidity can be

ignored. The effect of temperature change is easily the most predominant of the three remaining weather elements, and the heating requirements vary directly with the change in temperature.

Effect of Temperature

For our purpose we have adopted the degree day deficiency method as a basis for calculating heating requirements. This method assumes that heating becomes necessary when the mean temperature for the day falls below 65° F. Therefore, the number of degrees of mean temperature below 65° is expressed as so many degree days. This mean temperature of 65°, however, does not hold true in all sections. This can be explained very readily since the average mean temperature and weather conditions are not the same for the different sections of our system. In other words, in a section where the temperature is consistently higher than another section, the people will feel the need for heat at a higher mean temperature than those living in a section where the year-round temperature conditions are lower. However, since the vast majority of our customers are centralized within the area where 65° mean temperature appears to be the temperature at which heat is first required, it is for all practical purposes possible for us to use 65° mean. It is the customary practice to determine the mean temperature by taking the average of the maximum and minimum temperature occurring in 24-hour period. This method of determining the mean temperature for the greater portion of the time checks very closely with the average of the 24 hourly temperatures, but it has been found that the results from the two methods will differ as much as 3°. For the purpose of making studies to determine the relation of gas used to mean temperature, we believe the average of the 24 hourly temperatures should be used.

From the charts which we have prepared for San Francisco (Fig. 2) it appears that the gas load between the hours of 9 p.m. and 7 a.m. does not vary if the night mean temperature is in excess of 51° and the minimum temperature is greater than 48°. After determining the average night temperature and the minimum night temperature at which heating apparently starts, we prepared two sets of daily mean temperatures. In one case we used anything less than

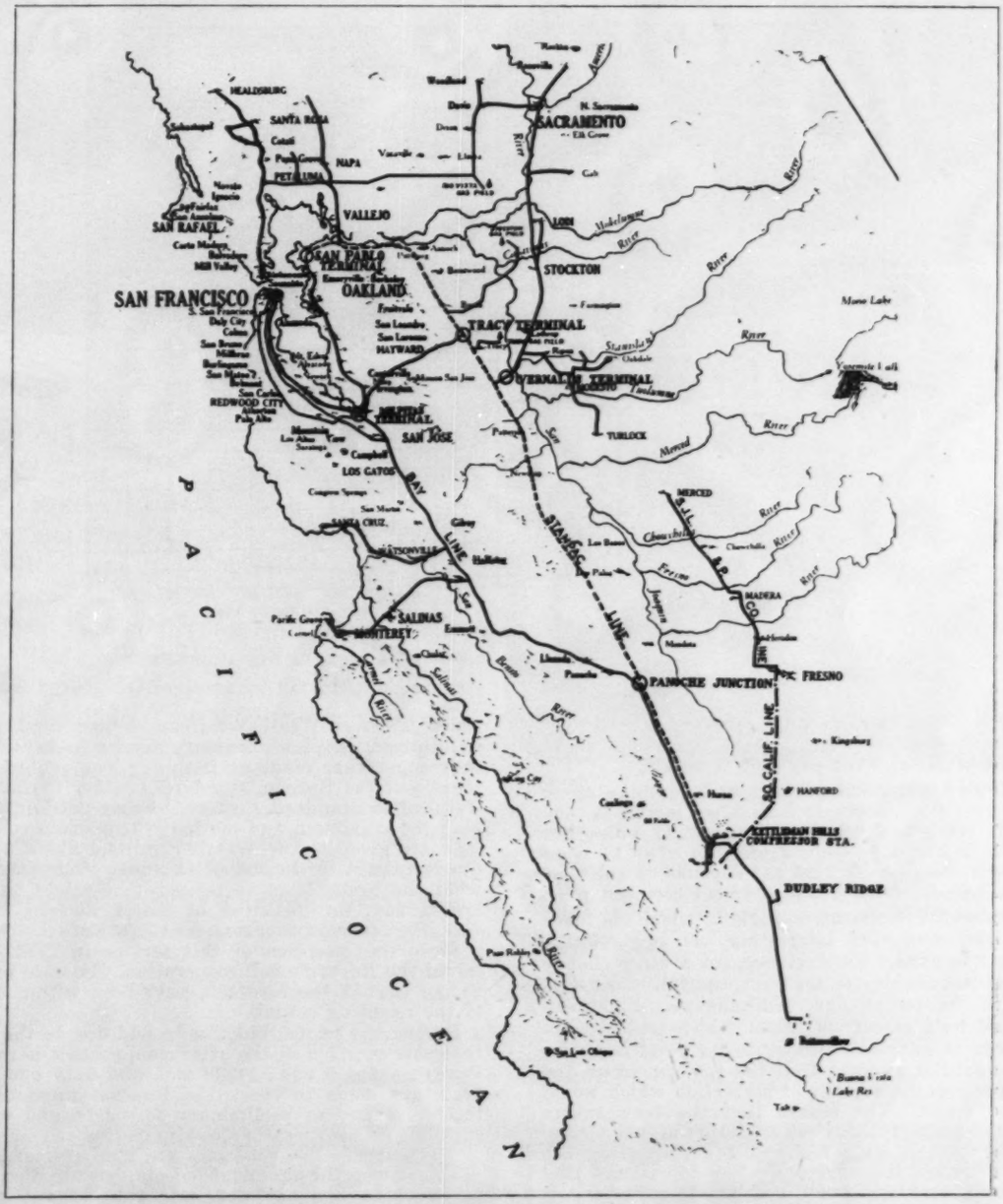

FIG. 1. System map of the Pacific Gas and Electric-Stanpac natural gas transmission system.

51° night mean temperature and in the other case anything less than 48° minimum night temperature. In plotting the night load against the night mean temperature, we found that the heating load varied per degree by 26 per cent of the amount of the variation in the total day's heating load per degree. We then determined the daily mean temperature by giving 26 per cent weight to the night mean and 74 per cent weight to the day mean. We thus had two figures for daily mean temperature, one being a weighted 24 hourly average mean and the other a mean of the maximum and minimum temperatures.

However, up to the present time we have not proceeded far enough with our study to determine the error in using the two mean temperatures with respect to gas requirements for heating purposes.

Effect of Sunshine and Wind

The effect on the day load of having 100 per cent sunshine appears to be the equivalent of raising the temperature approximately 3°. The effect of having a lesser amount of sunshine depends on the period of day the sunshine occurs. For practical purposes, the effect can be considered to be in proportion to the ratio of the per cent of sunshine.

The effect of wind movement appears to be nothing up to five or six miles per hour, thereafter its effect increases very rapidly until it reaches a velocity of about 12 miles per hour. (Curve 3 in Fig. 2.) Here again, the effect of wind movement in terms of cubic feet of gas depends on the time of day in which the excessive wind movement occurs.

From a very careful comparative analysis which we made of each day's load some very interesting, yet aggravating, deviations appear to exist. For instance, for a large change in temperature from one day to the next, the full effect does not appear until the second day. Offhand you might say that there should be a correction factor which could be applied to take care of various changes in the mean temperature, but here again it appears that the time at which the change starts governs the amount of correction which would be necessary to make. The reason that the temperature change does not become fully effective until the second day is probably due to the time required for the change to become effective within the dwelling. You might say that this should not be such a difficult problem to solve and it would not be, were it not for the fact that the amount of time involved is also subject to wind movement. In other words, if we have a heavy wind movement at the time the temperature is changing it becomes effective far more quickly than if the temperature is changing at a time of calm.

Weather Bureau Cooperation

In the early fall of the year 1932, we made a special study to determine the variation in our gas heating load in relation to the mean temperature. Having this information we believed that if we could determine what the probable mean temperature would be on the following day, we should be able to make a fairly accurate estimate of the next day's requirements. We were aware that the weather forecasts from the San Francisco Weather Bureau office were being made with a very high degree of accuracy. If it were possible to obtain a temperature forecast for our load centers from the Weather Bureau, greater accuracy would result in determining the probable degree-day deficiency for our gas system.

After discussing the matter thoroughly, the Weather Bureau agreed to give us the service we needed. However, the fact that it was necessary to have the forecast by 3:30 p.m., which is before Weather Bureau records were received from its stations, made it necessary for us to arrange to supply the temperature readings from our load centers, and, at the request of the Bureau, standard weather thermometers were installed in standard shelters. From these instruments are read the maximum and minimum temperature. These readings are given to the Weather Bureau about 3:15 p.m. and the Bureau with the aid of this and other data, determines what the probable mean temperature might be for the following day, for the cities of San Francisco, Oakland, San Jose, Sacramento, Stockton, and San Rafael.

Since the inception of this service in 1932, we have received the Bureau's full cooperation. To date approximately 85 per cent of the forecasts have been within three degrees of the resulting actual.

During the winter months, in addition to the temperature forecasts received in the afternoon, contact is made with the Bureau about 9 a.m., 11:30 a.m. and 6:15 p.m. These contacts are made to check the forecast previously given, to receive revised or preliminary forecasts, and to discuss the probable general weather conditions for the succeeding three or four days. The forecasts are used primarily, of course, in calculating the gas requirements, but are also passed along to our pipe line patrol maintenance crews. Having such information, they can more appropriately plan maintenance and repair work to be on the lookout for trouble from heavy rains, etc.

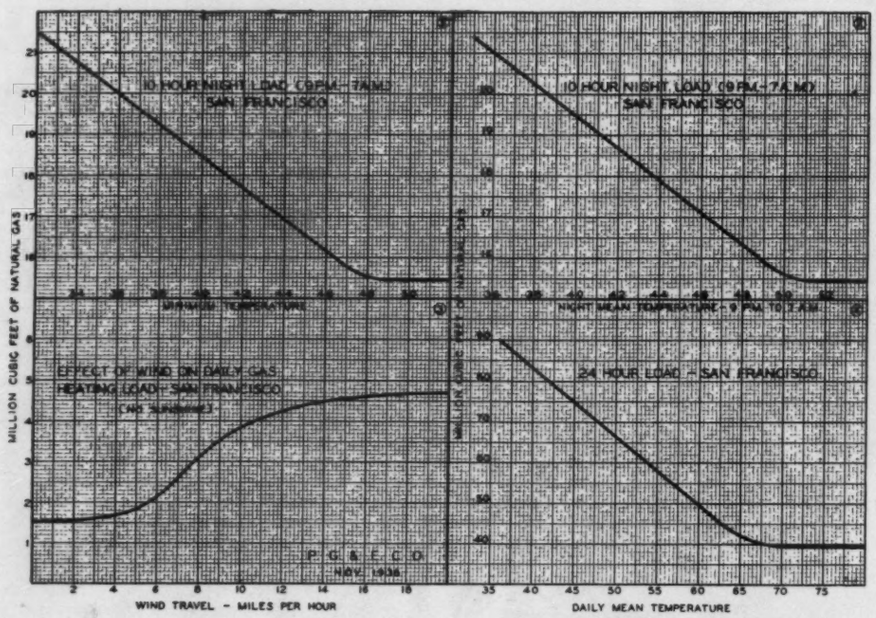
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FIG. 2.

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The task facing the gas load estimator can be summarized as follows:

After receiving the prediction of what will be the temperature, sunshine, and wind movement, the gas estimator must correlate this information into composite values and compare the day at hand with the previous day and the same day of the previous week. He must study and compare the conditions for the corresponding day of the previous week because the estimate is based upon that day.

The importance of temperature in each load center is in proportion to the number of customers served. Therefore, when the weight or importance of temperature in each load center is determined and added together, the result is a composite temperature which is representative of the system as a whole.

After computing the amount of gas load and correcting for the deficiency or overage in the storage supply he must allocate the production and advise the various producing companies.

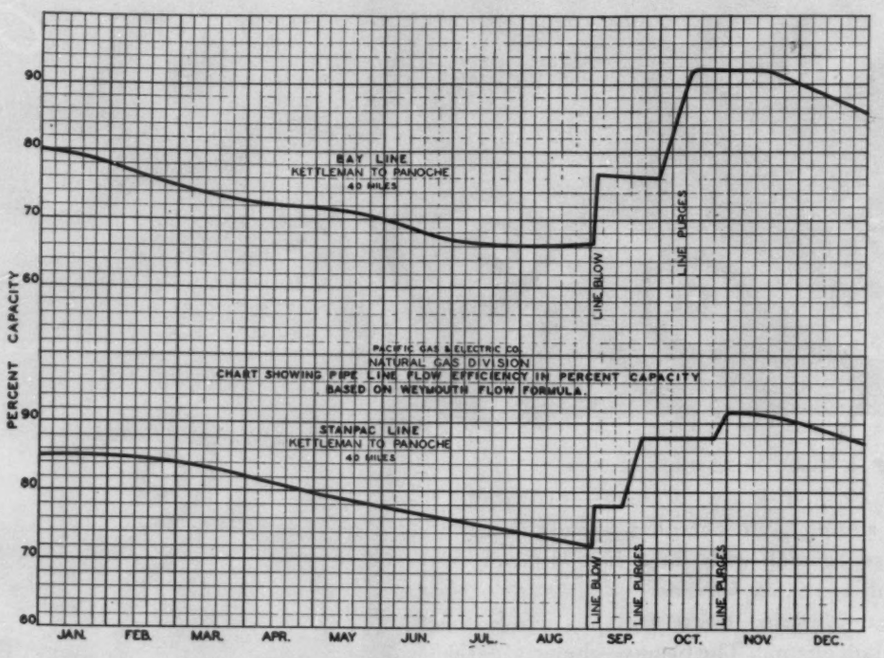

FIG. 3. Chart showing pipe line flow efficiency in per cent capacity based on Weymouth flow formula (for year 1932).

Maintenance of Facilities

To perform the natural gas dispatching functions the Gas Control dispatcher must be furnished with complete hourly and daily information relative to pressures, volumes, temperatures, and weather conditions from all patrol and control stations on the transmission lines and at distribution control stations in the various metropolitan areas. Having such complete information at hand, the Gas Control organization is well equipped to prepare from these data valuable information and reports for those who take care of maintenance and repairs of pipe lines and station equipment. It can readily detect operating inefficiencies and offer suggestions for their correction or improvement. For instance, old plants with complex piping arrangements may contain "bottle neck" restrictions, making it necessary to carry terminal pressures on the incoming transmission lines many pounds in excess of that necessary on the high pressure distribution systems. These few additional pounds of pressure at the terminal points mean reduction of the transmission line capacity. Although they may appear to be of only insignificant importance, oftentimes when put in terms of *annual* lost capacity, run into thousands of dollars in revenue. For example, the difference between maintaining 60 lbs. and 40 lbs. on the transmission lines at our Potrero gas plant in San Francisco would mean a reduction in the delivery to San Francisco of about 12 million cu. ft. per day. This, of course, is based on the assumption there would be no changes in the initial pressure at Milpitas. Although 20 lbs. at Potrero does not materially affect the overall transmission capacity, with the accumulation of similar pressure losses at intermediate regulating stations, the capacity losses can soon mount to rather large proportions.

The writer realizes that there is some point where the expenditure required to eliminate these pressure losses cannot be justified, especially if the capacity lost can be utilized only a few days each year. In most cases the original piping in such plants and stations did not contain "bottle neck" restrictions, but have resulted from small changes made from time to time to meet some new or temporary condition. For example, to receive gas coming in from the new Tracy field, it was necessary to reroute the gas at Milpitas, resulting in an additional 5 lbs. drop through that station. Also, rapid factory, residential, and business development in new sections, coupled with the continual development of hot water and house heating appliances in older sections, brings about the need for piping and plant equipment changes. The changes and additions in piping and plant equipment must be made if we are to give good and adequate service and yet handle these tremendously increased volumes of gas without large pressure losses.

Just as it is important to keep down the pressures required at the end of the transmision lines to obtain from them their greatest possible capacity, it is also important to install high pressure regulating equipment as close to the city limits as may be considered safe. This should be done to permit packing the transmission lines to the highest possible pressure at those points. This is especially important during the cold weather season. The amount of capacity to be gained during a 24-hour period is about one-half of the line pack in excess of the amount necessary for flow at normal pressures.

The Pacific Gas and Electric Co. and Standard Pacific gas transmission line systems contain approximately 575,000 cu. ft. of gas per pound of average pressure. In other words, for every 4 lbs. of excess line pack at the beginning of a heavy day's demand, we can deliver more than one million cu. ft. of gas in excess of the maximum capacity at open flow conditions.

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Having the transmission line packed to high pressure near the distribution centers is also desirable during the off-peak season. When regulation to a large load center is carried on at a point 40 or 50 miles away, the factor of "time" comes into the job of regulating to meet the hourly load. When changes of volume are not felt at the point of distribution for a period of approximately 45 minutes, the dispatcher must make use of the holders to take care of the errors in his hourly estimates. We have found that regulation of the volume to San Francisco and Oakland which is done at a distance of 40 miles, requires a minimum use of the holders of one and one-half million cu. ft. per day in each city. If regulation were handled at a distance of five to 10 miles from the point of distribution the "summer" use of the holders could be practically eliminated.

The Pacific Gas and Electric Co. has recently corrected this situation on one of its San Francisco lines by putting in a remote controlled regulating station seven miles from the Potrero gas plant.

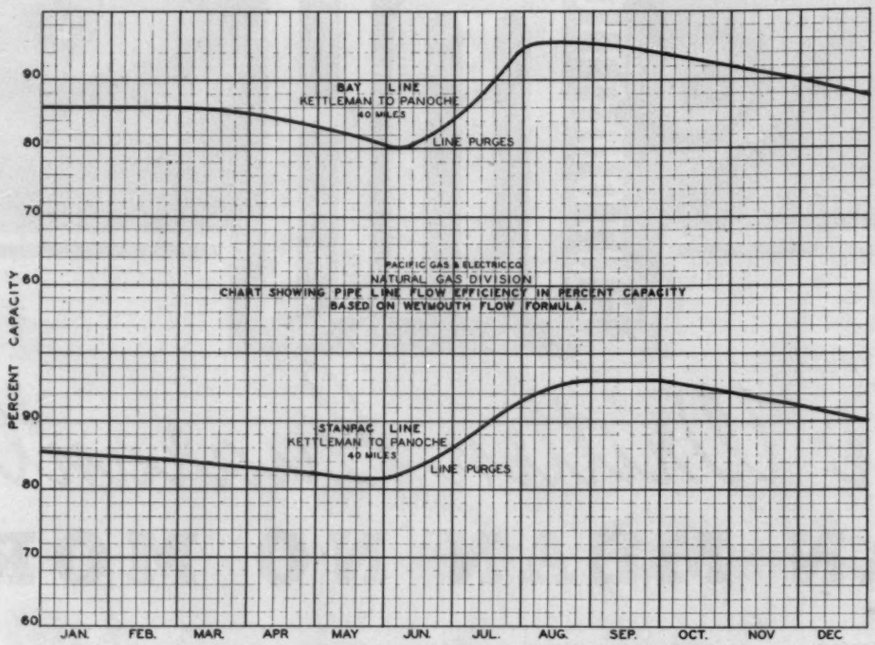

FIG. 4. Chart showing pipe line flow efficiency in per cent capacity based on Weymouth flow formula (for year 1933).

Pipe Line Efficiency

The transmission of natural gas has a serious problem in the control of internal corrosion and collection of foreign matter. This roughing condition in pipe lines can, within the period of one year, reduce the capacity as much as 15 per cent in the section affected. The cooperation between the Transmission department and the Gas Control office in the detection of this serious problem and the Pipe Line Operating and Maintenance departments' procedure and methods used for its correction may be of some interest.

One day during the late summer of 1932, about the time our heavy summer load was near its peak, we were discussing the seemingly high pressure required at Kettleman to deliver the gas needed. It was suggested that there might be an accumulation of liquid or foreign matter in the pipe line which was causing the need for such apparent high pressures. Using the pressure and volume records from the daily main line operating reports, the flow efficiency for all sections between the patrol stations and terminals was checked. The 40-mile section on both lines between Kettleman and Panoche Junction showed the alarming condition of having a flow efficiency of only 70 per cent capacity. To try and correct the trouble it was decided to first cut out a section of pipe midway between Kettleman and Panoche and then blow down each 20-mile section. For the estimated time the line would be out of service arrangements were made to cut back the flow of gas at Kettleman and to transfer some of the heavier industrial loads over to oil. The first operations were to open the crossover connections between the Bay line and Stanpac line at Panoche and then close in the Bay line between Kettleman and Panoche. The next step was to close in the 5-mile section midway between Kettleman and Panoche and open the blow-off valves, letting the gas packed in the 5-mile section blow out into the atmosphere. This done, a 12-foot section of pipe midway between the two valves was cut out and the "purge" fitting installed by means of Dresser sleeves.

The valve, two and one-half miles from the purge fitting, was opened wide, permitting the gas packed in the 15 miles of pipe to "purge" through the line and blow out through the purge fitting into the atmosphere. The blowing was continued for about 30 minutes. The gas blown to the air contained some mist and heavy dark brown iron oxide dust.

After completing the "blow," the purge fitting was reversed and the blowing operation repeated on the opposite section. The 12-foot section of pipe was then replaced, using Dresser sleeves, and the line was again placed in service. On the following day the flow efficiency of the line was again checked, and indicated only a very small improvement, even though several thousand gallons of liquid and large amounts of dust were blown from the line. However, after inspecting the interior walls of the pipe when the 12-foot section of line was cut out, the men in charge of the work were not surprised to learn that little improvement was shown.

After some discussion as to a method to use in tearing loose and cleaning the corrosion from the pipe walls, the idea was conceived to use steel lathe turnings. The operations for purging the line with lathe turnings were almost identical to those used in blowing the line out. There were three "valved" sections closed in, with the gas in the middle section blown to the air, after which the blow-off valves were removed and then about 12 cu. ft. of lathe turnings were poured through the blow-off into the main line. The blow-off valves were then replaced and closed. When the purge fitting had been put in place, the man stationed at the main line valve was instructed to open the valve, leaving it open for a given length of time, usually about three to five minutes. This procedure was duplicated for each 5-mile section. The amount of foreign matter blown out was

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astounding. From inspection of the pipe in one of the 5-mile sections cleaned, it was estimated that several tons of dirt, corrosive globules, and foreign matter were cleaned out and blown from the line. Figs. 3, 4 and 5 show the flow efficiency in per cent capacity for the Kettleman to Panoche section on the P. G. and E. Bay and Stanpac lines. Fig. 3 is for the year 1932, Fig. 4 for 1933, and Fig. 5 for 1936. The curves on Figs. 3 and 4 show the improvement in flow efficiency as a result of purging operations and the decline thereafter.

As the result of a thorough study to determine the best means to prevent the continual corrosive action, the cooling towers at our Kettleman station were enlarged sufficiently to allow the gas to be cooled to near ground temperature before leaving the station. This, of course, makes it possible to condense and take the water out of the gas before it enters the transmission lines. Fig. 5 reveals in the continued high flow efficiency the effectiveness of the enlarged cooling towers.

The flow efficiency is calculated daily by the Gas Control for all sections which have been found to be most affected

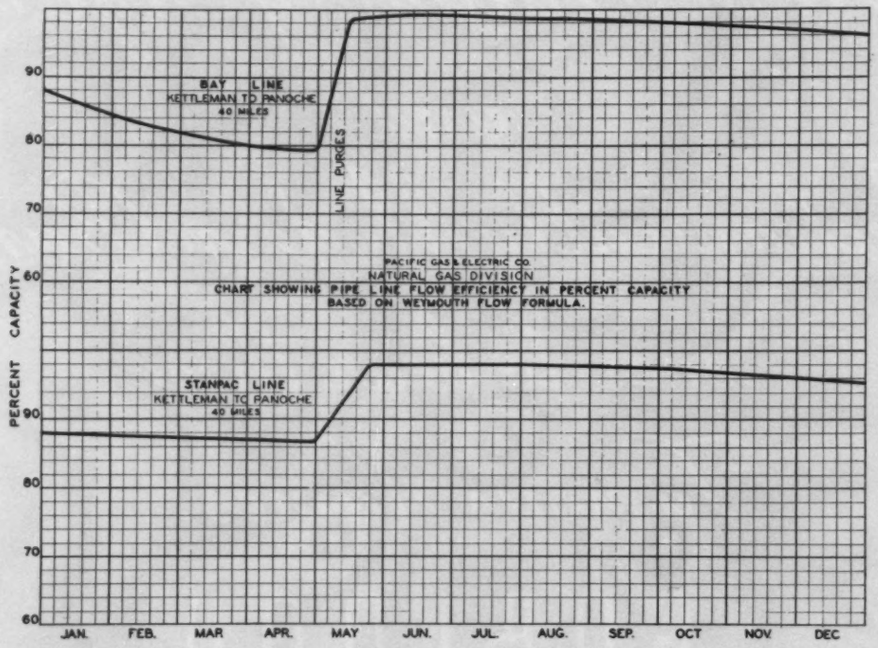


FIG. 5. Chart showing pipe line flow efficiency in per cent capacity based on Weymouth flow formula (for year 1936).

by corrosive action; other sections are checked only periodically. The daily efficiency checks besides indicating the presence of foreign material in the pipes, also reveal faulty meters and pressure gages, as well as pipe line breaks. The superintendent of pipe lines receives from Gas Control office, in addition to the per cent capacity at which the lines are operating, information pertaining to the general load conditions, impending rain storms, etc. Having such information he can more appropriately plan maintenance and repair work and be on the look out for trouble from heavy rains, etc.

When it becomes necessary to shut down a transmission line to repair a bad line break, there must be close contact and cooperation between the Pipe Line department and others, and the Gas Control. If there were not, we could not maintain uninterrupted service to our customers. To illustrate, a leak was discovered and reported by a rancher at 1:00 p.m., Sunday, January 17, 1937. The break was in our 20-in. Bay line and located 69 miles northwest of Kettleman in the Antelope Hills. The leak consisted of a weld broken open 13 inches around the pipe. About 3:00 p.m., the repair crew reported that due to the extreme cold weather, coupled with the freezing action of the expanding gas, the ground was frozen solid to a depth of four feet and that a shut-down might be necessary. Excavation was not completed until 12:30 a.m., January 18. At 2:30 a.m., they reported to the Gas Control that two unsuccessful attempts had been made to install a Hatton type leak clamp under pressure. The vent in the clamp was not sufficiently large to pass the large quantity of gas escaping at a line pressure of 350 lbs., causing the gasket to blow out before the clamp could be tightened down against it. They reported that although they probably could install a split sleeve, it would require about four more hours of excavating with the possibility that the rupture might open farther as more earth was dug away. They recommended a shut-down, with repairs made by welding. To do this would require from 2 to 4 hours, which meant repairs possibly would not be completed until about 6:00 a.m.

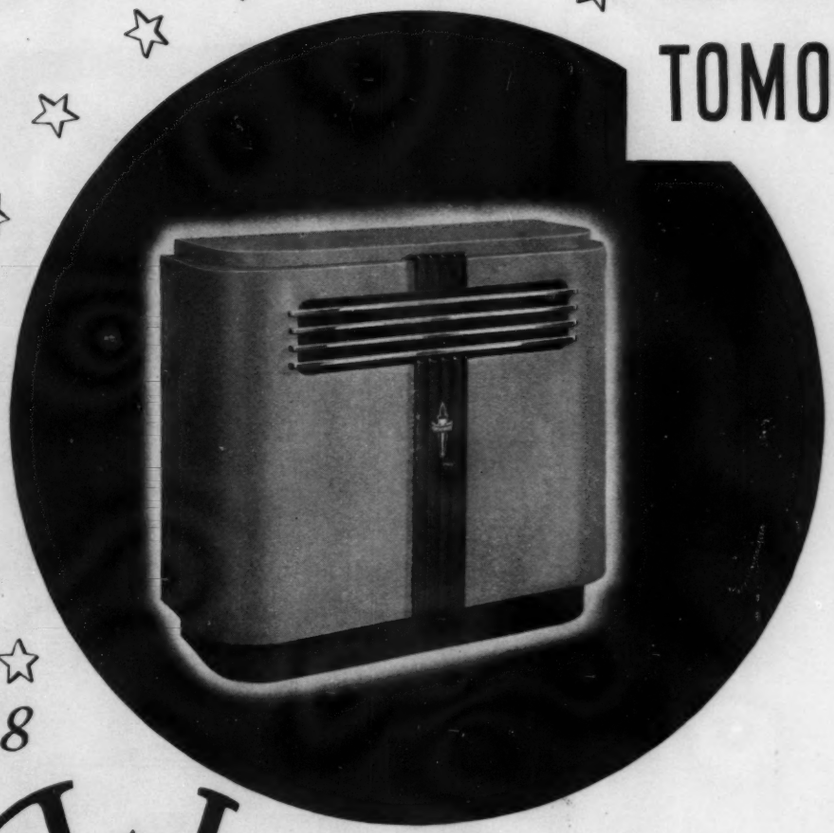
To have the line out of service after 5 a.m. would make it necessary to transfer about 50 million cu. ft. a day load over to oil. To do this for only a few hours must, if possible, be avoided. After learning this the repair crew then suggested the shut-down be made only for the time necessary to install a Hatton leak clamp, welding it to the pipe after the section was packed and the line again in service. To do that, they estimated would require a shut-down for about one hour.

The necessary volume of gas was cut back at Kettleman and the 3.8-mile section closed in, blowing the gas to the atmosphere. This completed, the Hatton leak clamp was put in place over the break and pulled down tight to the pipe with the vent left open. The section was then repacked, the clamp tested, after which the line valve north of the break was opened, putting the line again in service. This line was out of service only 48 minutes. Welding of the clamp to the pipe was completed and the vent valve closed at 7:15 a.m., January 18.

Without the close contact and cooperation between the Gas Control and the pipe line repair crew, the routine repairs by shut-down and welding would have been carried out, resulting in a lot of inconvenience and change-over expense to some of our large customers.

During the past winter (1936-1937) all recorded cold weather records were broken, and along with it all previous load demands were broken. It placed upon the personnel and the system the most severe test to which it had ever been put and, although complaints were many, we weathered the storm and came through still having a supply of gas in storage at the end of each day's evening peak. At the lowest point we had on hand in San Francisco about 27 per cent of the total storage capacity. The peak demand which occurred on January 20, 1937, was 402 million cu. ft., which was an increase of 65 per cent over the previous peak which occurred in 1932.

AS *New* AS TOMORROW



The 1938

WEDGEWOOD

GAS CIRCULATING HEATER

A Compliment to Any Living Room— Gracefully designed in a modern motif, these new Wedgewood Heaters add real beauty to the home! Three sizes . . . two lovely colors, Sandtone and Seal Brown . . . Morocco finish . . . smart chromium trim.

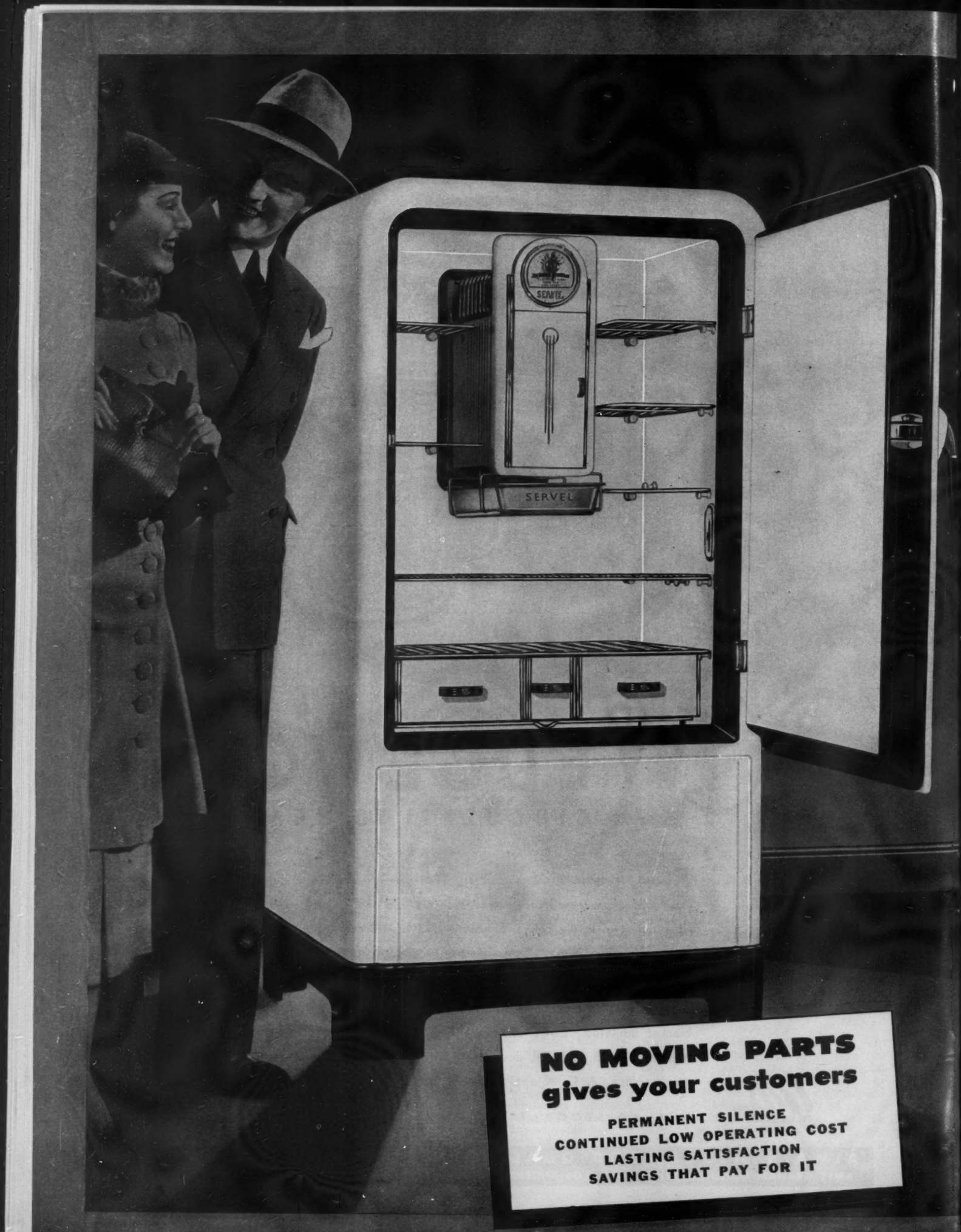
High-efficiency combustion system delivers the maximum heat from gas used—keeps several rooms comfortably warm. Outer cabinet and bottom are air-blanket insulated. Large one-piece ribbed steel heating unit has non-corrosive high-heat finish. Special down-draft diverter. Automatic lighter. Low flue fits any fireplace. A. G. A. approved—vented and unvented.

Gas THE MODERN FUEL

THE ARISTOCRAT OF GAS CIRCULATING HEATERS

ALWAYS WEDGEWOOD QUALITY—MAKES FRIENDS FOR GAS

JAMES GRAHAM MANUFACTURING CO. • LOS ANGELES • SAN FRANCISCO • NEWARK, CALIF. • PORTLAND, ORE.



NO MOVING PARTS
gives your customers

PERMANENT SILENCE
CONTINUED LOW OPERATING COST
LASTING SATISFACTION
SAVINGS THAT PAY FOR IT

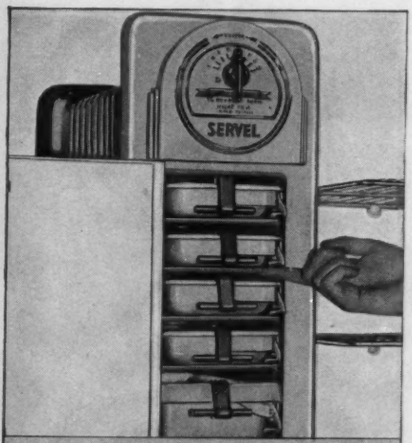
ANNOUNCING THE NEW 1938

SERVEL
ELECTROLUX
THE *Gas* REFRIGERATOR

FAMOUS OPERATING ADVANTAGES

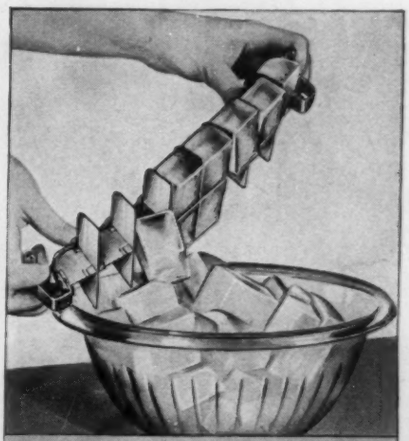
PLUS

NEW IMPORTANT SELLING FEATURES

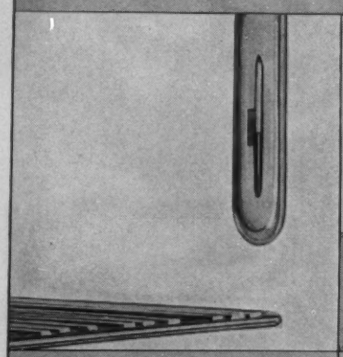


LEVERAGE IS THE SECRET of the ease with which Servel Electrolux trays may be taken out. A gentle lift on the trigger, and out slips the tray. When nearly out of the compartment, raise tray abruptly at the front end. This motion will loosen the entire grid of ice cubes.

YOUR BIGGEST OPPORTUNITY to build sales and gas load. That's what the new 1938 Servel Electrolux gives you. Because this year's gas refrigerator has more sales appeal than ever before. For example, show your customer the new, flexible, stainless steel ice cube release. Let her see how ice cubes literally spring from the grid. Show her the many other improved features of the 1938 Servel Electrolux. Tell her about the silence and savings of the "no moving parts" principle. And she'll *want* this new Servel Electrolux. She'll want it *right now.* So, start today on your biggest year with the gas refrigerator—and build gas load for years to come. Servel, Inc., Evansville, Indiana.

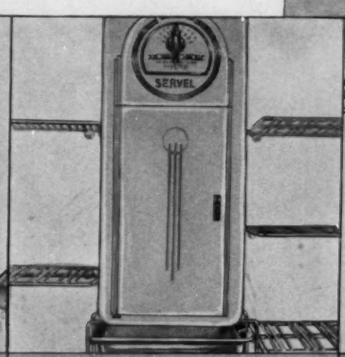


TWENTY PER CENT MORE ICE is obtained by means of these flexible, stainless steel grids, with which all trays in Servel Electrolux de luxe models are equipped. And you can get all the ice cubes at once, or one at a time—right at the refrigerator. No mess, no ice loss.

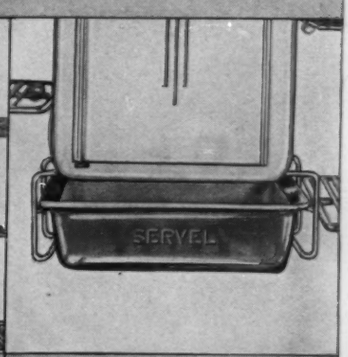


NEW, EASY-TO-READ COLD INDICATOR assures you that your Servel Electrolux is operating at constant low temperature.

FREEZING SPEED AND DEFROSTING are governed by this new, convenient, indirectly illuminated temperature dial.

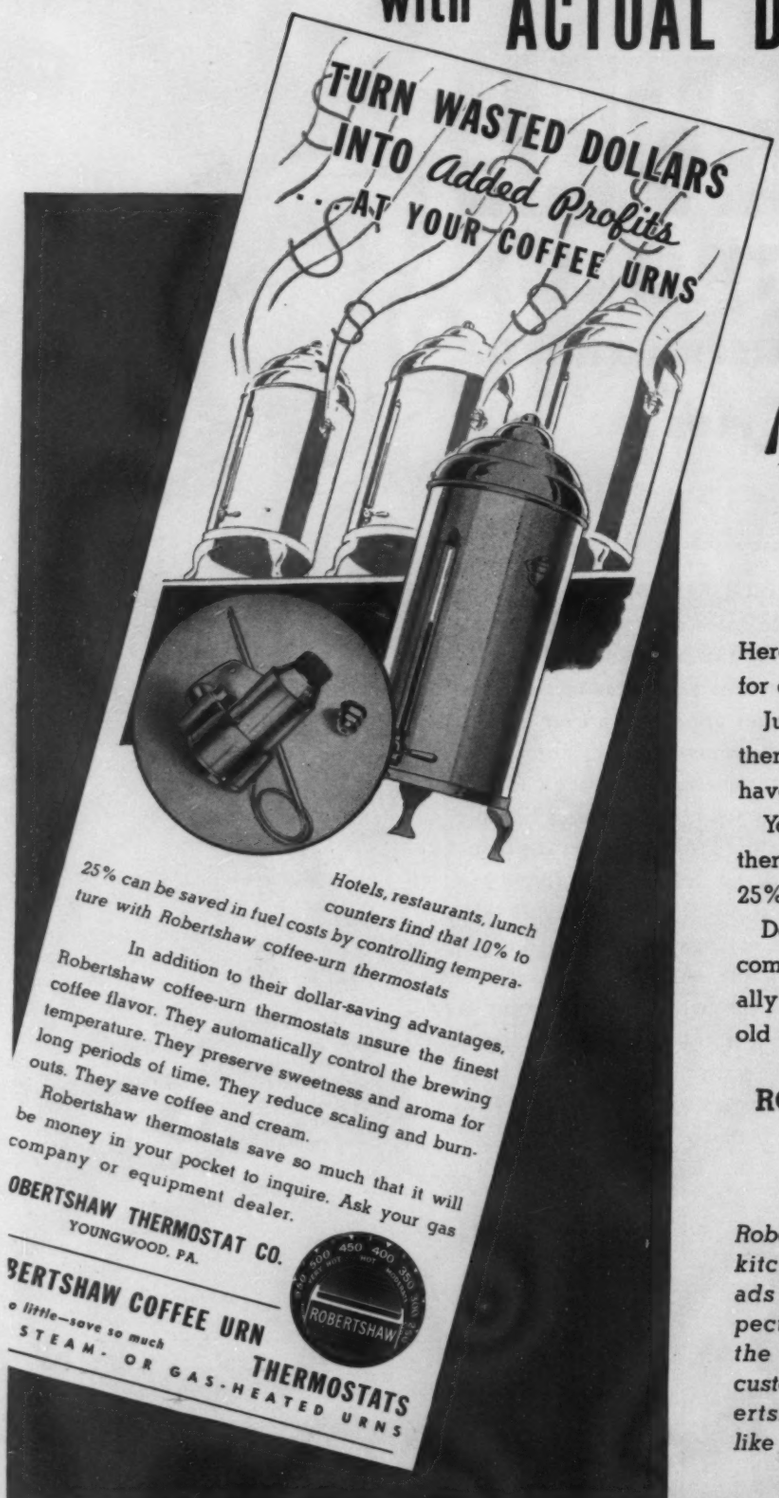


NEW, ONE-PIECE TRAY FRONT lends a neat, orderly appearance to the interior of the modern 1938 Servel Electrolux.



ADJUSTABLE TO TWO LEVELS, this capacious cold storage tray accommodates steaks, roasts or other food.

PROVE the VALUE of MODERN EQUIPMENT with ACTUAL DEMONSTRATIONS


TURN WASTED DOLLARS INTO Added Profits
. . . AT YOUR COFFEE URNS
Hotels, restaurants, lunch counters find that 10% to 25% can be saved in fuel costs by controlling temperature with Robertshaw coffee-urn thermostats
In addition to their dollar-saving advantages, Robertshaw coffee-urn thermostats insure the finest coffee flavor. They automatically control the brewing temperature. They preserve sweetness and aroma for long periods of time. They reduce scaling and burnouts. They save coffee and cream.
Robertshaw thermostats save so much that it will be money in your pocket to inquire. Ask your gas company or equipment dealer.
OBERTSHAW THERMOSTAT CO.
YOUNGWOOD, PA.
BERTSHAW COFFEE URN THERMOSTATS
o little—save so much
STEAM- OR GAS-HEATED URNS
ROBERTSHAW

For example

PROVE IT WITH A *Robertshaw-equipped* COFFEE URN

Here's a demonstration that will get you orders for complete kitchen modernization. Try it!

Just ask restaurants to install a Robertshaw thermostat at (for example) a coffee urn. Then have them check the savings.

You'll get sales results because Robertshaw thermostats have made fuel savings of 10% to 25% and more!

Demonstrations like these plant the seeds of complete kitchen modernization. They've actually caused whole restaurant chains to replace old urns with new Robertshaw-equipped urns.

ROBERTSHAW THERMOSTAT CO.
YOUNGWOOD, PA.

Robertshaw helps you sell kitchen modernization in ads that go to your prospects. Take advantage of the publicity. Give your customers a sample of Robertshaw savings. They'll like it—and ask for more.

ROBERTSHAW COFFEE URN THERMOSTATS
Cost so little—save so much

New Line to Carry Casinghead Gas to Michigan Corp.

PERMISSION to construct a 14-mile 4½-inch O. D. transmission line from the Sherman oil field to Mt. Pleasant, Mich., has been granted by the Michigan Public Utilities Commission to Utilities Pipe Line Co., a subsidiary of Gas Corp. of Michigan, which supplies natural gas in Mt. Pleasant, Clare, Rosebush, and surrounding territory. Incorporators are Charles M. Sturkey, W. J. Somerville, and J. L. Boone.

Utilities Pipe Line Co. has contracted with Otha H. Grimes for the purchase of stripped casinghead gas. A plant is to be erected for stripping and processing. It is estimated that 1,500,000 cu. ft. of gas will be available daily after January 15, 1938.

Gas Corp. of Michigan, whose supply of gas in the Clare and Vernon fields is now inadequate, has also contracted with Consumers Power Co. for natural gas to be delivered at the rate of not more than 800,000 cu. ft. a day until April 15, 1938.

■ ■

Domestic Users Upped 252,000 In First Eight Months

Domestic customers served by manufactured and natural gas utilities totalled 15,816,700 on August 31, an increase of 252,000 during the first eight months of 1937, according to Paul Ryan, chief statistician of the American Gas Association. More than a million gas ranges were sold in the country during the first eight months of 1937. This was an increase of 13 per cent over the first eight months of 1936.

Revenues of manufactured and natural gas utilities for the first eight months of 1937 increased 4.6 per cent over the corresponding period of 1936.

Revenues of the natural gas industry for the first eight months gained 7.8 per cent over a year ago. Revenues from industrial uses increased 17.5 per cent, while revenues from domestic uses gained 3.7 per cent.

■ ■

A.G.A. Sponsors Course At University of Kansas

University of Kansas offers a home study course in natural gas under the sponsorship of the American Gas Association. Covering all phases of the business from geology to utilization, the course, according to A. G. A., is completed by most students in two years, though some with training and experience have finished it in five months.

The American Gas Association, the Pacific Coast Gas Association, or the University of Kansas will send literature and blanks. Enrollments are accepted at any time.

■ ■

S. L. Montgomery Retires

S. L. Montgomery, operating engineer of the compressing station department, Pittsburg & West Virginia Gas Co., Pittsburgh, Pa., retired recently. He had been with the utility since 1914. Prior to joining the Pittsburgh company he was superintendent of compressing stations for Indiana Natural Gas and Oil Co.

Pacific Coast Gas Association's Golden Gate Exposition Committee.

P. C. G. A. Committee Views Sites For Golden Gate Fair Exhibit

The committee charged by the Pacific Coast Gas Association with the responsibility of planning and financing an exhibit worthy of the gas industry at the Golden Gate International Exposition, San Francisco, Calif., visited the exposition grounds on November 5 to inspect the possible exhibit sites. In the photograph from left to right are H. W. Jackson, Jas. Graham Manufacturing Co., representing C. R. Graham, a member of the committee; Clifford Johnstone, managing director, Pacific Coast Gas Association; Harry H. Daley, representing the Exposition; R. E. Fisher, vice-president of the Pacific Gas and Electric Co. and chairman of the committee; and Harold R. Basford, H. R. Basford Co. Missing from the picture are W. W. Norton of the Electrogas Division, Payne Furnace & Supply Co., who took the picture, and R. A. Hornby, vice-president of the Pacific Lighting Corp., who was not present.

The site tentatively selected for the gas industry exhibit is in the Homes and Gardens Building where some 7,000 square feet of space is being held in the name of the Association pending the final decision on whether or not a gas supply will be available in the Fair Grounds.

Calendar

December

Association of Gas Appliance and Equipment Manufacturers, Direct Heating Division—Netherland Plaza Hotel, Cincinnati, Ohio, December 2.

Exposition of Chemical Industries—Grand Central Palace, New York, N. Y., December 6-11.

National Association of Manufacturers—Waldorf Astoria Hotel, New York, N. Y., December 8-9.

Pacific Coast Gas Association—Fall Conference, Fairmont Hotel, San Francisco, Calif., December 16-17.

January, 1938

Compressed Gas Manufacturers' Association—Annual Meeting and 25th Anniversary, Waldorf-Astoria Hotel, New York City, January 17-18.

National Bottled Gas Association—Waldorf-Astoria Hotel, New York City, January 19.

Fifth International Heating and Ventilating Exposition—Grand Central Palace, New York, N. Y., January 24-28.

February, 1938

Southern Gas Association—Hotel Adolphus, Dallas, Texas, February 16-18.

New England Gas Association—Hotel Statler, Boston, Mass., Feb. 24-25.

June, 1938

Canadian Gas Association—31st Annual Convention, Royal York Hotel, Toronto, Ont., Canada, June 9-10.

Sellman of Servel Appointed A.G.A.E.M. Treasurer

F. E. Sellman, vice-president of Servel, Inc., has been appointed treasurer of the Association of Gas Appliance and Equipment Manufacturers to fill the vacancy caused by the death of its former treasurer, the late Donald McDonald.

Active in the gas industry, Mr. Sellman has served on various committees of the American Gas Association since 1927. He is now a member of the managing committee of the A.G.A. Commercial Section, and also a member of its Refrigeration Committee.

Mr. Sellman is best known for his work in building up the prestige of the Servel Electrolux refrigerator through his connection with Servel, Inc., of Evansville, Ind., as that company's consulting engineer in the pioneering period of gas refrigeration and as its vice-president in charge of sales, advertising, and sales promotion from 1931 to 1936.

Mr. Sellman was one of the incorporators of the Association of Gas Appliance and Equipment Manufacturers of which he is now a director as well as treasurer. He is also a director of Gas Exhibits, Inc.

■ ■

Goldie C. Viele Resigns From Natural Gas Department

Miss Goldie C. Viele, for a number of years assistant secretary of the Natural Gas Department of the American Gas Association at Dallas, resigned, effective November 15, to become secretary to Captain A. E. Higgins, vice-president of Pittsburgh Equitable Meter Co. Miss Gladys Daulton, formerly of Tulsa, Okla., but for the past three years with the Home Owner's Loan Corp. at Dallas, has been employed as successor to Miss Viele.

Focal point for gas men attending the National Metal Exposition in Atlantic City recently was the American Gas Association's combined Industrial Gas Exhibit shown above.

Gas Exhibit Is Prominent at Metal Exposition

ONE of the focal points of interest at the National Metal Exposition of the American Society for Metals in Atlantic City, October 18-22, was the Combined Industrial Gas Exhibit sponsored by the Industrial Gas Section of the American Gas Association in cooperation with gas companies and manufacturers of industrial gas equipment.

E. D. MILENER

A distinctive layout and color scheme for the A. G. A. exhibit was prepared under the direction of Raymond M. Martin, art director, Consolidated Edison Co. of New York. Each of the 12 cooperating manufacturers limited exhibits to a few pieces of gas equipment, thereby obtaining a high degree of visibility. At the four corners of the intersecting aisles was the circular booth of the American Gas Association, which was surrounded by the booths of the cooperating industrial gas equipment manufacturers. An innovation was the elimination of fences, partitions and back walls. A runner-sign bearing the slogan-chart "The Trend Today is to Gas" and other slogans encircled the top of the exhibit. There were approximately 87 gas equipment company officials, engineers, and experts in attendance to answer any questions.

The personnel of the Committee on Displays at National Industrial Expositions of the Industrial Gas Section, who sponsored the A.G.A. combined industrial gas exhibit, is as follows: H. A. Sutton, chairman, T. J. Gallagher, Paul Dorchester, C. C. Krausse, P. A. Nelles, Jr., A. A. Schuetz and Roy P. Wilson. Eugene D. Milener, secretary of the Industrial Gas Section, was director of the exhibit.

A general get-together breakfast was given by the Industrial Gas Section to the equipment manufacturers and members of the Managing Committee at the Ambassador Hotel, Tuesday morning. Alexander Forward, managing director of the American Gas Association, attended.

Many technical papers of interest to the gas man were presented at the sessions. Most of these were on heat treating and steel making. Those of immediate interest were: "Gaseous Media for Carburizing" by G. T. Williams, Cleveland Tractor Co., Cleveland; "Furnace Atmospheres and Decarburization" by J. A. Webber, Interstate Drop Forge Co., Milwaukee; "Commercial Gas Carburizing" by L. D. Gable and E. S. Rowland, Timken Roller Bearing Co., Canton, Ohio; "Light Cases by Gas Carburizing" by V. T. Malcolm, Chapman Valve Manufacturing Co., Indian Orchards, Mass., and "The Process of Dry Cyaniding" by R. J. Cowan and J. T. Bryce, Surface Combustion Corp., Toledo, Ohio.

Book on Refractory Practice Listed as Valuable Aid

"Modern Refractory Practice" (second edition) is a combined handbook, technical review, and catalog of 295 pages, published by Harbison-Walker Refractories Co., Pittsburgh, Pa., which, the foreword states, is the world's largest producer of refractories. In addition to chapters on fireclay, high-alumina, silica, magnesite, chrome and forsterite refractories, there are chapters on special clays, mortar materials, ramming mixtures, and insulating materials.

The prospective user of refractory products will find of particlar value the formulas useful in calculating brickwork; tables of brick combinations for circles and arches; temperature conversion tables; temperature end points of American pyrometric cones, with a comparison of American and European cones; melting points of metals and alloys, minerals, and oxides; fusion points of ash and slags; approximate furnace temperatures for various kinds of furnaces, color scale for temperatures, weights of various materials, conversion tables, and thermal conductivity.

Included also is a glossary of terms in common use, and a list of minerals with a brief description of each.

Price of the book is $2.50, but it is offered without charge to users of refractories. For student use, the price to faculty members of universities and colleges is $1.25 for single copies and $1.00 in lots of six or more.

■ ■

Public Service Co. of Indiana Elects Pardee Comptroller

Election of D. P. Pardee as comptroller of Public Service Co. of Indiana is announced by Robert A. Gallagher, vice-president of the company.

Mr. Pardee has been associated with the Stone and Webster Service Corp. in New York City. He was elected by Public Service Co. to fill the vacancy caused by the resignation of L. B. Schiesz, who has been elected vice-president and general manager of Northern Indiana Power Co.

For the past five years, Mr. Pardee has been providing financial and accounting service to operating utilities. Prior to that, he was treasurer of the Consolidated Electric and Gas Co.

■ ■

Dates for P.C.G.A. Fall Conference Changed

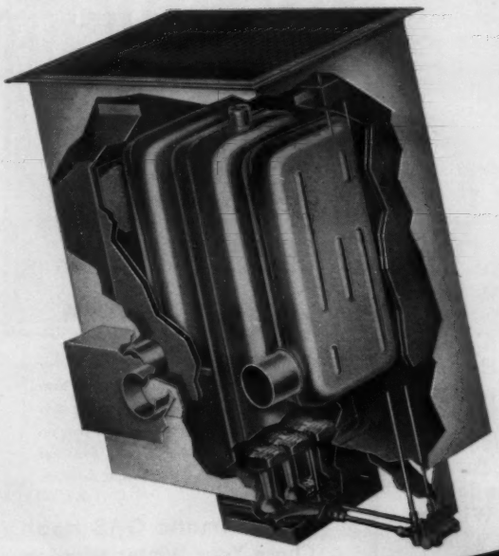
The dates of the Fall Conference of the Pacific Coast Gas Association, which was originally scheduled to be held on December 15 and 16 have been changed to December 16 and 17, according to word received from Clifford Johnstone, managing director of the Association. The place of the meeting remains the same—the Fairmont Hotel, San Francisco, Calif.

■ ■

John R. Armstrong Dies

John R. Armstrong, sales supervisor of Portland Gas & Coke Co., died recently, following an emergency operation. Death came only three weeks after his appointment as sales supervisor.

what—STAYS OUT OF SIGHT —ALWAYS KEEPS QUIET —YET SELLS GAS RIGHT AND LEFT



You're Looking At It!

The Payne Floor Furnace

The Payne Floor Furnace is bringing complete comfort to thousands of homes. But it is doing more than that. Its eye-opening efficiency is putting over a convincing selling job for GAS.

Because it uses a minimum amount of GAS, the Payne Floor Furnace enjoys a maximum amount of use. It is called upon when ordinary furnaces would remain unlighted.

That's why Payneheat helps put the kind of a load you want on your lines. A sustained, month-in-and-month-out load, not just seasonal peaks.

And because The Payne Floor Furnace gives economical and flawless service, it sells the *idea* of GAS. It gives people pride in their heating appliances, *their fuel.* It starts them talking about GAS —in the right way!

Get acquainted with the Payne Floor Furnace—another modern product of America's most modern furnace plant.

Payne FURNACE & SUPPLY COMPANY, INC.
Beverly Hills, California

Oklahoma Co. In Successful Six-Point Sales Campaign

By JOHN H. WARDEN

General Sales Manager, Oklahoma Natural Gas Company

OKLAHOMA law forbids public utilities to merchandise or even rent gas equipment, and so, when Oklahoma Natural Gas Co. plans its sales promotion, we must take into consideration things which will enlist the active support of the several hundred dealers who dot our territory. Such a plan was worked out for our fall merchandising activity, and was built around the sale of automatic water heaters and floor furnaces. We set down six objectives:

1. To stimulate sales before the normal buying period.
2. To increase the automatic water heater sales in the fall off-season period.
3. To reach all dealers who are scattered throughout our territory.
4. To establish friendly contacts with house heating and water heating dealers.
5. To enlist the interest of manufacturers in the things which can be done in our territory.
6. To educate architects and builders and other craftsmen in the need for better appliances than they are now installing.

The question of how to interest not only the owners of stores and the managers of departments, but the men and women on the firing line, including the small plumbers who work from their cellars and who carry their office records in their vest-pocket, was the most serious part of the plan to be considered.

Mr. Strickland of Southern California Gas Co. had mentioned to me the splendid results he had obtained from his Red, White, and Blue water heater contest in April. It seemed to us that here was the answer to one of our problems — contact with the small dealers.

And so the main features of this Red, White, and Blue contest were incorporated in our Sooner Sweepstakes: the award of merchandise prizes to dealers, the value of which would be dependent upon the number of units they sold during the six weeks' activity, every sale to give them some kind of prize, and the more sales made, the better the prizes would be.

Our own sales managers, district managers and home service department participated in this contest through the medium of a Sooner Sweepstakes contest, built around the idea of a rush for the treasure known to exist in Sooner City. Without going too much into detail about this contest, such obstacles as Fullapep Prairies, the River of Uncertainty, the Desert of Wasted Opportunities, the Manana Indians, etc. were pitfalls in the path of progress into the rich claims mapped out in Sooner City.

As for the dealer's part in this activity, the following items were made available to him: 1—Newspaper Advertising. 2.—Bill Inserts. 3.—Automobile Cards and Card Holders. 4—A series of four letters to prospective builders. 5—A series of four letters to water heater prospects. 6—A series of four letters to floor furnace prospects. 7—A series of seven letters to architects and builders. 8—Window displays. 9—Store cards and window banners. 10 — The use of company stores for display purposes. 11—Employees' leads. 12 — Prizes to individual salesmen.

Our newspaper advertising build-up began in June and continued throughout the summer, culminating in a more intensive campaign during the drive, August 30 to October 10. A sales managers' meeting, at which the plan was presented, was followed by dealer meetings in the individual territories. At those dealer meetings both plumbers and floor furnace dealers were in attendance, and sound slide films demonstrating the possibilities within their own territories were shown. Refreshments were served and the campaign was off to a good start.

The material, nearly all free, was supplied to the dealers upon their written request. Uniform newspaper trademarks designating dealers as participants in the campaign were made available to them through their newspapers in order that our advertising and theirs might tie in through these identifying marks. At the same time, meetings of our employees were being held in the various districts, and employees were encouraged to turn in the names of prospects, for which bonuses were paid when the merchandise was sold. We also ran spot announcements on two powerful

Is Your
Home HAUNTED
In Winter
Do Cold Weather Bogeys Haunt Your Home During the Winter Months?
Drafts, cold floors, sweating walls — infamous cold weather bogeys—are banished when you install Automatic Gas Heat. Constant, sure warmth is your insurance against "common colds" and other ills due to inadequate heating facilities.
Let Automatic GAS Heat Chase Your Winter Worries
"Little Bill" Says:
"Now is the time to see your dealer about that Floor Furnace! Be prepared when winter gets here!"
Floor Furnace Dealers are Offering Convenient, Deferred Payments to Those Placing Their Orders Now
Oklahoma Natural Gas Company

More

GARLAND COMMERCIAL GAS COOKING EQUIPMENT

sold this year than for any similar period in the history of our company!

This sales record has a deep significance for gas company executives who are interested in commercial cooking equipment. It is unmistakable evidence that Garland gas-fired equipment is constantly proving its efficiency and economy in operation.

The list at the left includes both new and "modernization" installations—names which in themselves prove that Garland equipment meets the requirements of the country's most critical purchasers.

Partial List of Recent Garland Gas-Fired Installations

Hotels

Adolphus, Dallas
Astor, New York City
Bancroft, Worcester, Mass.
Curtis, Minneapolis
Jung, New Orleans
Kimball, Springfield, Mass.
Morrison, Chicago
Wm. Penn, Pittsburgh
Schroeder, Milwaukee
Statler, Cleveland

Restaurants

Child's, Syracuse, N. Y.
Longchamp's (all locations), New York City
Old Heidelberg, Chicago
Schrafft's (all locations), New York City
Ship Ahoy, Atlanta

Hospitals

City-County, Houston
Presbyterian, Chicago
St. Anne's, Columbus

Clubs

Detroit Athletic Club, Detroit
Rochester Club, Rochester, N. Y.
Union League Clubs, Philadelphia, Chicago

GAS IS THE IDEAL FUEL
and at its best with Garland Heavy Duty Appliances

DETROIT-MICHIGAN STOVE CO. • DETROIT

Drawing the winning numbers in the Sooner Sweepstakes for managers of Oklahoma Natural Gas Co. From left to right, standing: W. Jennings Young, vice-president; H. Vinton Potter, merchandise sales manager; D. W. Edwards, industrial engineer; L. A. Farmer, superintendent. Seated is John H. Warden, general sales manager.

radio stations. In addition to all this, some of the local jobbers held meetings of their own to make sure that their own dealers capitalized on the plan we had drawn up.

Each dealer was given a supply of tags: yellow ones with a 200-point value for heaters selling for less than $50; salmon colored tags with a value of 300 points for heaters selling between $50 and $75, and green tags with a value of 400 points for heaters selling for $75 and over. These tickets were to be filled in completely by the salesmen when a unit was sold and sent to us when the unit was actually installed. By selling a great number of units, a dealer was able to amass a sizeable score. A catalog, sent to each salesman at the beginning of the campaign, contained a description of about 150 premiums, showing him what he could win by diligent effort. The nice part of the whole arrangement was that the man who sold only one unit still could earn a premium.

We set a quota of 2,000 units, based on the preceding year's record and the apparent rate of increase for the first eight months of 1937. The final tickets showed a total of 3087 units, or over 50 per cent beyond our quota, and about 100 per cent beyond our last year's records!

Salesmen who never before had been interested in our merchandise were intensely interested because of this campaign. Many of our prizes were earned by women. Testimonials from dealer salesmen throughout the territory showed that they actually neglected other merchandise to sell the units we were stressing during this campaign period. Dealers everywhere are already looking forward to an even bigger drive next year.

We are greatly indebted to the manufacturers for their support, morally and financially, in this activity, because without them it would not have been possible. A form letter addressed to them when the campaign was first conceived, asking them to buy the tags from us at the end of the campaign — buying only those tags which represented actual sales of their heaters during the six-weeks' period —met with enthusiastic response. We are sure that the results obtained by this cooperation between manufacturer, utility, jobber, and salesmen, has reacted to the mutual advantage of all.

Eighty Papers Discussed at Corrosion Conference

THE fourth national conference on underground corrosion sponsored by the National Bureau of Standards at Washington, D. C., on November 15-17, offered 80 papers, and was attended by approximately 75 out-of-town conferees. Dr. L. J. Briggs, director of the Bureau, gave the address of welcome.

All papers were printed well in advance of the conference. Those on a single topic were reviewed by a specialist in that line and then the meeting opened to general discussion. Those who presented reviews and the subjects they covered were as follows:

Corrosion of Lead, by Dr. R. M. Burns, Bell Laboratories.

Corrosion of Iron and Steel, by Dr. F. N. Speller, National Tube Co.

Protective Coatings, by Scott P. Ewing, American Gas Association.

Pit Depths and Pipe Line Condition, by L. M. Martin, Bureau of Standards.

Soil Testing, by Erick Larson, Long Island (N. Y.) Lighting Co.

Electrolysis, by A. H. Schirmer, Bell Laboratories.

Cathodic Protection, by J. F. Putnam, Standard Oil Co. of California.

On the afternoon of the last day a round table was held for discussion of problems of members of the conference.

On Monday evening motion pictures were shown, and on Tuesday evening the Washington and Baltimore sections of the American Institute of Electrical Engineers held a joint meeting to hear papers on electrolysis and corrosion by W. G. Radley, Post Office Research Station, London, England; C. P. Fetherstonhaugh, University of Manitoba; and C. M. Longfield, Victoria (Australia) State Electricity Commission. Dinner in honor of the speakers preceded this joint meeting.

The conference was planned by K. H. Logan, chief of the Underground Corrosion Section of the Bureau.

Mid-West Gas School Features Testing Demonstration

With a registration of 150, the seventh Mid-West Gas School and Conference was held at Iowa State College, Ames, from November 10 to 13 under the joint sponsorship of the Engineering Extension Service of the college and the Mid-West Gas Association.

Outstanding in the program was the half day devoted to demonstration, explanation, and discussion of specialized testing equipment by F. A. Mueller, chemist, and C. F. Holdredge, engineer, Metropolitan Utilities District, Omaha.

Other speakers during the four-day school included Kenneth R. D. Wolfe, Fisher Governor Co.; C. E. White, Waukesha Motor Co.; Allen D. MacLean, Pittsburgh Equitable Meter Co.; C. B. Dushane, American Meter Co.; L. K. Spink, The Foxboro Co.; H. J. Carson, Northern Natural Gas Co., Omaha, Neb.; Lester J. Eck, Minneapolis Gas Light Co.; Robert L. Klar, Champaign, Ill.; Amos H. Abbott, Northern States Power Co., Minneapolis; Robert F. Galpin, Iowa Electric Co., Muscatine.

L. W. Mahone, Iowa State College, presided as chairman.

Time was allotted each day for inspection of the exhibits presented by twelve companies. An elk dinner was held Friday night.

■ ■

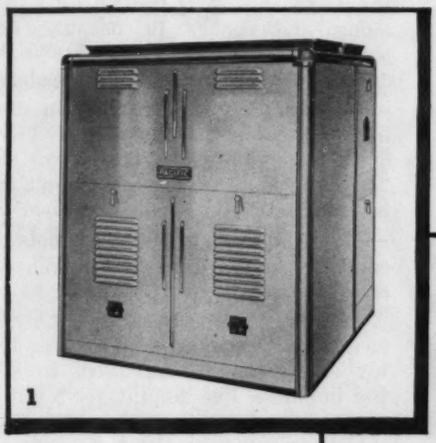
Changes in Peoples Natural

H. E. Wedge, district superintendent at Ashland, Neb., for Peoples Natural Gas Co., has been transferred to Wayne, according to announcement by the company. L. G. Hepworth, Glenwood, succeeds Mr. Wedge at Ashland. D. S. Van Buren, Pawnee City, takes Mr. Hepworth's place at Glenwood.

From LARGEST to SMALLEST

Pacific Makes the Most Complete Line of Gas Heating Appliances

For every industrial, commercial and residential heating requirement . . . for every climate from sub-arctic to sub-tropical . . . for natural or butane gas, there's a Pacific gas heating appliance that will give greater satisfaction and show a lower operating cost. Pacific pioneering is responsible for many oustanding developments in gas heating, including the Pacific Safety Pilot and the Multi-Tubular Burner. Depend on Pacific appliances to build your winter load. Write for catalog G12.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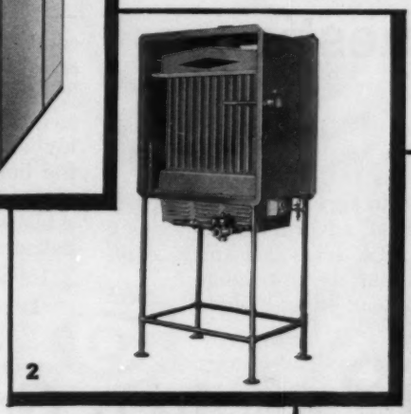
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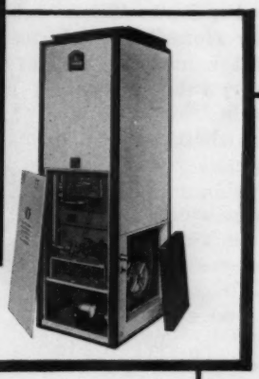
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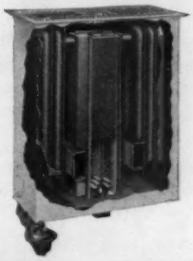
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1 **PACIFIC STREAMLINE DE LUXE**
Completely automatic forced-air heating and ventilating. Streamline casing furnished in attractive crackle finish with chromium trim. All controls completely enclosed.

2 **PACIFIC DUCT UNIT**
Designed for duct work on commercial, industrial and residential installations. Capacities from 55,000 to 300,000 BTU. Can be coordinated with summer cooling equipment to give year 'round air conditioning.

3 **PACIFIC FORCED-AIR UNIT**
Winter heating and summer ventilating in one compact, highly efficient unit. No basement required.

4 **PACIFIC GRAVITY FURNACE**
The basement type of warm air furnace is one of the most popular in the Pacific line. Thousands in successful use for many years.

5 **PACIFIC FLOOR FURNACE**
Circulates fresh warm air to every corner, giving even temperature so necessary for health and well-being. Eliminates damp, sweaty walls. Operates with extreme economy because of Pacific's famous Multi-Tubular Burner.

6 **PACIFIC THERMOLATOR**
One of the most efficient room heaters ever devised. Exclusive cast iron heating element "holds heat" longer. Vented and unvented types.

7 **PACIFIC RADIANT HEATER**
Pacific manufactures a wide variety of radiant heaters, both wall and portable types. Individual burner units permanently adjusted at the factory.

PACIFIC GAS RADIATOR COMPANY

1740 WEST WASHINGTON BLVD., LOS ANGELES, CALIFORNIA

SALES SLANTS

A month by month presentation of experiences on the sales front.

To Sell or — Not To Sell? Answer These Questions

"IF a salesman is slipping, one of two things is true*: He isn't working, or he isn't working *right*."

We do not know who first coined this simple statement, but every salesman ought to paste it in his hat. You, as a salesman, know whether you're working. If you're not, you know what to do about it.

If, on the other hand, you're working but not getting a proper result —not making a proper degree of progress—ask yourself the following questions once a week. If you can't answer every one of them in the affirmative, you've made a substantial progress toward discovery of what's wrong with your technique.

1. Am I so completely sold on my own company and my own products that I sell with enthusiasm and ringing conviction? (The first and usually the foremost characteristic of the star salesman.)

2. Have I analyzed last week's lost sales to discover what was wrong with my presentations? (Why make the same mistakes over and over?)

3. Have I planned my work for the day and week ahead? (Every lost hour is lost potential income.)

4. Have I planned to make *sales* instead of just *calls?* (Whether you sell anything or not, every call you make should in some degree advance your progress toward a sale at some future time.)

5. Am I following some systematic plan on a year-round basis to train myself to be a better salesman? (Your future hangs on what you do today.)

6. Am I watching and studying the technique of salesmen who are better than I am, so that I can adopt and adapt some of their ideas? (Many a salesman who is now in the five-figure salary class got there by this simple means.)

7. Am I, in appearance, and deportment, a good advertisement for my company? (A seedy salesman, careless in manner, is unwelcome.)

8. Do I fear buyer's objections, or do I recognize them as an opportunity to do my most skillful selling? (Objections are an evidence of interest or an excuse for not buying, more often than a valid *reason* for not buying.)

9. Is my follow-up relentless, or am I too easily discouraged by one or two turn-downs? (You do most of the work, then your competitor comes along and cashes in because he's there asking for the order after you've crossed the prospect off as hopeless.)

10. Am I sportsman-like in dealing with competitive matters? (How often have you heard some buyer say, "His line is all right, but I don't like his methods"?)

11. Am I using the sales tools my company makes available? (Why be an amateur all your life?)

12. Am I properly servicing my accounts after they are sold to see that my customers are satisfied, to keep the business I've fought for? (Little courtesies of service safeguard many a big account from the piracy of competitors.)

Have you been honest with yourself in your answers?

* From *Gastack* (Feb. 15, 1937), Consumers' Gas Co. of Toronto, Toronto, Ont., Canada.

Beauty in a Gas Range Is Only Metal Deep

BEAUTY is an important point of the modern gas range story, but it sometimes gets more emphasis than it deserves, according to a salesmanager whose success and long record in selling commands respect. Here are his thoughts approximately as he expressed them to me:

"To my mind it is a sad state of affairs when a housewife purchases a modern gas range with no better reason for doing so than the fact of its beauty.

"I don't mean to lessen the importance of beauty in the sales appeal. Strip the range of its attractiveness and no matter how extraordinary as a piece of cooking equipment, it would have but a slim chance in a competitive market.

"Beauty is important. But my point is that salesmen sometimes make it all important—a place it does not deserve in the selling story. A $125 gas range can be made to have an eye appeal almost equal to that of a range $50 higher in price.

"A housewife who is allowed to base her selection only upon what she sees could hardly feel justified in choosing the higher priced range.

"Those simple letters, A, B, C, D and the others used to identify those all-important health elements known as vitamins have done more to sell yeast cakes, California oranges and what have you than all the tales of beauty.

"A salesman who gets an order for the better quality gas range sells a great deal more than mere beauty. He sells better health through vitamin cooking, not to mention economy and leisure, and he delivers it symbolized in a piece of equipment of striking beauty.

"I realize that it is much easier for a salesman to talk to the prospect about things her eye can meet. And I also realize that it is natural for all of us to favor the line of least resistance. But I also know from actual experience that it will pay cash dividends to push the beauty point into the background of the sales story, or at least out of position number one.

"I have taken great pains to be sure

that every man on my sales force appreciates that the principal appeal should be pointed toward cooking. As a consequence, they are going out to tell a story of cooking—health cooking. If the point of beauty enters the story at all it will be secondary."

■ ■

Wisconsin Power & Light Co. Holds Novel Golf Contest

Keyed to the summer season was the Mashie Masters Open Golf Contest conducted for ten weeks by Wisconsin Power and Light Co., which resulted in sales totaling 100.9 per cent of quota, according to Paul De Leon, commercial manager.

The tournament was a 100-hole match. Quotas were set in "yards," and 1 per cent of quota equaled one hole. Each of the 14 districts was sponsored by two caddies, whose job it was to keep the clubs in good order and help the players in studying their shots.

Three division sales meetings, held at golf clubs, started the contest. Promotional material included newspaper advertising on water heating, cookery, and kitchen modernization. Billboards in June emphasized refrigeration, and in July, cookery. One piece of the three-piece "Kettle Club" set was presented to a user turning in the name of a prospect who became a buyer of certain specified appliances. Cash and other prizes were offered for different activities.

■ ■

Close Home Service Contest For All-Gas House Name

A contest to find a name for the all-gas homes now being built under the nation-wide home-building program of the American Gas Association's Home Appliance Planning Bureau closed on November 30. Home Service directors and assistants in home service departments were eligible to enter the contest. A prize of $200 will be awarded to the person sending in the winning name. Under the rules of the contest, a paragraph of not more than 50 words had to be submitted with each title suggested. A jury of prominent magazine writers and A. G. A. members is selecting the winning name.

Two other contests form part of the Home Appliance Planning Bureau program, one for architects and one for builders (*G A S*, November, 1937).

■ ■

Pacific Coast Gas Revenues Up 7.8% in September

Revenue of Pacific Coast gas companies increased 7.8 per cent in September over September a year ago, according to statistics released by Paul Ryan, statistician of the American Gas Association. Included in the survey were California, Arizona, Nevada, Oregon, Washington, and British Columbia, Canada.

Gas sales were up 3.1 per cent, and gas customers numbered 3.5 per cent more than a year ago in September.

Natural gas statistics for California during the month showed that revenue increased 7.2 per cent, gas sales 0.2 per cent, and customers 3.8 per cent.

Servel's Traveling Show Features 1938 Models

THE Figueroa Play House in Los Angeles, Calif., was the scene on November 16 of the first of a series of regional sales conferences with which Servel, Inc., is introducing the 1938 Electrolux gas refrigerator. An estimated crowd of 1200, including gas utility representatives, sales representatives, and dealers from all sections of the Pacific Coast, attended the function.

Feature of the meeting was a dramatic presentation of the 1938 models on the stage of the theater, scenic effects being used to emphasize the outstanding points of the new refrigerator and the superior qualities of gas refrigeration.

After the opening of the conference, the auditorium was darkened. Curtains opened on the lighted stage, showing a landscape illustrating the silence with which the Servel Electrolux refrigerator is operated. In large letters across the sky appeared the words: "Silent Night—and Day." Other scenes illustrated the mediums of advertising, the promotional literature of the company, the trailers that move about the countryside to aid salesmen in contacting prospects, and finally, the new 1938 Servel Electrolux model shown in the center of the stage with the spotlight upon it.

This traveling show has been presented also in Kansas City, Dallas, and Chicago. The 1938 models were first shown at the annual sales meeting of Servel held in October at French Lick, Ind., and attended by leading sales executives of gas utilities from all sections of the country.

Two changes in the 1938 Servel Electrolux, according to George S. Jones, Jr., vice-president and general sales manager, are: a device in the de luxe models whereby ice cubes can be obtained with ease; and a "disappearing hinge" which eliminates all hinge parts from the exterior of the cabinet.

The new device for obtaining ice cubes is a stainless steel release. When a slight pressure is exerted on the release, the cubes are expelled together or one at a time. It is estimated that 20 per cent more ice is obtained in this way, because there is no loss in melting.

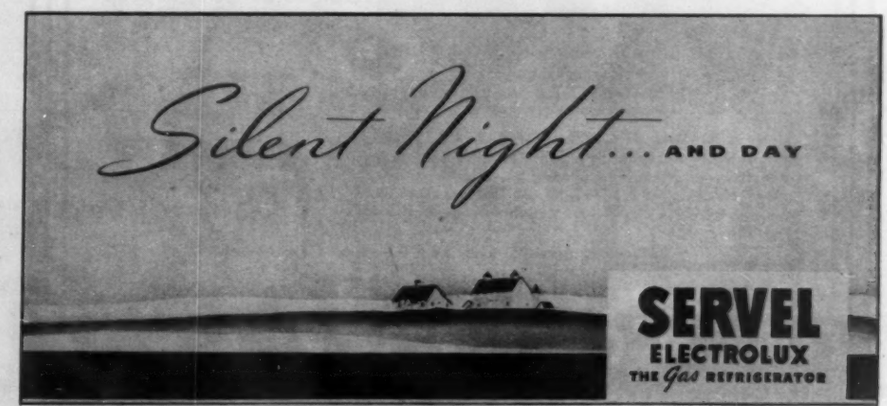
The new type hinge is more rugged than the old type because it is in the form of a heavy curved band that disappears into the frame of the cabinet as the door is closed.

A door in front of the freezing unit in the 1938 models results in less frost accumulation. Another new feature is the "easy-to-read" cold indicator.

■ ■

Book Covers Business Manners

Business etiquette is the subject of "Profits from Courtesy," a new book by Mary Alden Hopkins, author of a number of self-help books. Chapter by chapter, the author covers every phase of American business activity from communication to beauty parlors and moving picture houses, revealing the basic principles of customer approach and the refinements that years of experience have brought to each business. The book is called a handbook for the new employee, for the experienced employee who is anxious to better his position, and for the employer who wishes to direct his personnel to a handbook of sound and helpful advice. Published by Doubleday, Doran & Co., Inc.



One of the scenes in Servel's traveling sales show.

Water Heater Contest Ends; 1938 Plans Outlined

THE 1937 Golden Faucet Contest, which for the past eight months has been sponsored by the Water Heating committee of the Commercial Section of the A. G. A. and the Gas Water Heater division of the A. G. A. E. M. in an effort to promote the sale of automatic gas water heaters has come to a close. Active leaders throughout the sales event were J. W. West, Jr., secretary of the A. G. A. Commercial Section, and H. N. Ramsay, chairman of the Gas Water Heater division of the A. G. A. E. M.

H. N. RAMSAY

During the eight-month campaign more than $18,000 was awarded to salesmen and to their companies, and according to the latest contest bulletin, sales records have surpassed those of any previous year, running 42 per cent ahead of 1936.

Represented in this year's drive were companies with 69.7 per cent of the nation's gas meters, an increase of 42 per cent over 1936.

Final cash awards totalling $3200 were given to the 65 leading salesmen, competing in seven divisions according to the number of meters served by their companies. Bronze plaques of merit were presented to the 21 gas companies leading in water heater sales.

Division winners among the salesmen were: First division, P. V. Hilton, Washington Gas Light Co.; second division, J. Healy, Central New York Power Co.; third division, R. A. Dummer, Blackstone Valley Gas & Electric Co.; fourth division, L. A. Brown, Iowa Public Service Co.; fifth division, W. E. Hill, The Argus Pipe Line Co.; sixth division, M. C. Overley, Central New York Power Corp.; seventh division, Bert G. Brown, The Kansas Pipe Line & Gas Co.

The seven division first place winners among gas companies were: Washington Gas Light Co., Washington, D. C.; Atlanta Gas Light Co., Atlanta, Ga.; Blackstone Valley Gas & Electric Co., Pawtucket, R. I.; Houston Natural Gas System (outside city of Houston), Houston, Texas; Peoples Natural Gas Co., Omaha, Neb.; Mountain Fuel Supply Co. (Wasatch Natural Division), Salt Lake City; The Kansas Pipe Line and Gas Co., Norton, Kan.

While the Golden Faucet Contest was drawing to a close, plans were being formulated for a more comprehensive drive for 1938. The new sales event will be known as the 1938 Automatic Hot Water Heater Prize Parade. It will again be a double-barrelled affair, a part of the effort being expended to promote gas company sales and a part to stimulate dealer efforts.

During November Mr. Ramsay visited the Pacific Coast and outlined the 1938 project to western water heater manufacturers and to key gas company sales executives. The plan as outlined was well received by the western group.

The Prize Parade will be two months longer than the 1937 contest, beginning on January 1 and extending through October. Merchandise prizes are being substituted for cash awards. According to Mr. Ramsay, this should allow for a much greater distribution of sales awards and stimulate interest among a much larger national sales force.

■ ■

A. G. A. Requirements O. K.

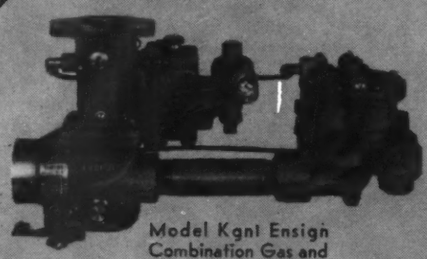
Revised requirements for domestic gas ranges, hotel and restaurant ranges, draft hoods, water heaters and semi-rigid tubing (*GAS*, Sept., 1937, p. 46) were approved as American Standard by the American Standards Association on October 22. These standards are to become effective on January 1, 1938. Printed copies are obtainable from the American Gas Association Testing Laboratories, 1032 East 62nd Street, Cleveland, Ohio.

■ ■

Consolidated Edison On Air

Consolidated Edison System, in a new radio series entitled "New York on Parade, Today and Tomorrow," is featuring Dr. Orestes H. Caldwell, scientist, John B. Kennedy, commentator, and Mark Warnow and his orchestra. A program is broadcast each Monday from 7:30 to 8 p. m. over Station WEAF.

DEPENDABILITY



Model Kgnl Ensign Combination Gas and Gasoline Carburetor

The wide acceptance of Ensign Carburetors and Fuel Regulating Equipment over a period of many years by a large majority of internal combustion engine manufacturers*, is a tribute to Ensign's unfailing dependability in service.

* Ensign products are used as standard equipment by a large majority of the manufacturers of internal combustion engines for industrial purposes.

Using either gas or gasoline for fuel, the Ensign Combination Carburetor provides equally fine precision fuel regulation with either fuel—assuring a new high in efficiency and a new low in fuel consumption from your power unit. Write for complete description

Butane Equipment, Gas and Gasoline Carburetors for Industrial Engines and Tractors

ENSIGN CARBURETOR CO., Ltd.
HUNTINGTON PARK • CALIFORNIA
Branches: Chicago, Illinois; Dallas, Texas

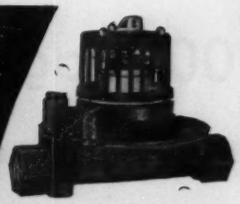
NOW YOU CAN STANDARDIZE ON SNAP-ACTING CONTROLS FOR UNIT HEATERS SPACE HEATERS AND COMPLETE CENTRAL SYSTEMS

If you want to build into your heaters controls that are economical, easy to install, simple to service — controls that have no delicate parts to wear out and give you trouble — then specify *Klixon Controls.* Different from others, Klixon controls — whether gas or electric — are operated by the Spencer disc — a simple, compact thermostatic disc that does away with such devices as toggles, bellows, magnets — a sturdy, dependable vibration-proof disc of bi-metal that snaps "on" or "off" *instantly* without hesitation or fluttering, at your desired control temperatures.

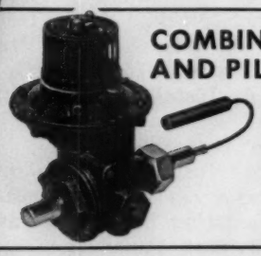
Manufacturers, salesmen and servicemen are demanding Klixon controls. Now with the complete Klixon line — operated by the Spencer disc — it is possible to provide, for all types of heaters, snap-acting, cost-cutting control.

KLIXON
TRADE MARK REG. U.S. PAT. OFF.

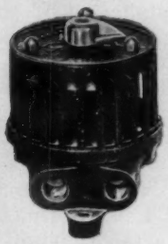
SPENCER THERMOSTAT CO.
ATTLEBORO MASSACHUSETTS



GAS-ACTUATED TEMPERATURE CONTROL UNIT Here is an economical gas-actuated control unit for such gas space heating appliances as space heaters, radiators, floor furnaces, circulators, range burners, and garage heaters. It consists of a Klixon gas-actuated thermostat mounted directly on the main diaphragm valve. Complete unit is easily installed close beside the heater.

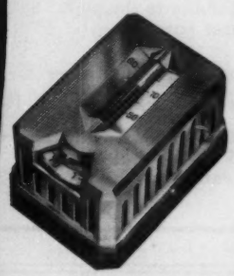


COMBINATION TEMPERATURE CONTROL AND PILOT SHUT-OFF VALVE This complete simple unit gives you all the advantages of the control unit above, and in addition assures positive protection against continued flow of gas should pilot go out. Manual resetting of burner is required. Complete unit is easy to install. The cost is low.



REMOTE GAS CONTROL FOR GAS HEATERS All Klixon diaphragm valves can be operated remotely by a Klixon gas-actuated thermostat mounted at any convenient spot. The complete operation is by gas. No wiring. Gas tubing from thermostat to diaphragm valve is either over the surface or concealed. Complete installation is simple. Low cost and de luxe types available.

REMOTE ELECTRIC CONTROL FOR GAS HEATERS With this new Klixon electrically operated gas valve, it is possible to control gas heaters remotely by means of Klixon electric thermostats. And with this valve you get no hum or flutter. For it is thermally operated by the Spencer disc and has an operating time delay of 30 seconds. A simple, dependable, and economical unit for all types of installations.



ELECTRIC ROOM THERMOSTATS FOR HEATING AND COOLING These compact, attractive, KLIXON electric Thermostats are snap-acting, dustproof, sensitive. They can be supplied for either heating or cooling or both. Given a precision setting at the factory they retain their adjustment permanently. Any desired temperature is set by the calibrated dial at the bottom of the thermostat. An operating differential of ¾° F. plus or minus insures a straightline room temperature.

OTHER KLIXON CONTROLS In addition to the above controls, Klixon offers you disc-operated gas thermostats for hot water heaters, a number of different pilot shut-off valves, unit heater gas switches, temperature and pressure relief valves for hot water heaters, pilot burners and many others. Send for new complete catalog.

SPENCER THERMOSTAT CO., Forest St., Attleboro, Mass.
Gentlemen:
Send me without obligation your new complete catalog.

MR.....POSITION.....
FIRM.....
ADDRESS.....
.....

Finish $5,000,000 Program For Los Angeles Area

SOUTHERN California Gas Co. and Southern Counties Gas Co., Los Angeles, are winding up a $5,000,000 construction program, which was started during the summer to assure adequate supply of fuel during the heavy peak demands of the winter season. Among the bigger projects now being pushed to completion to reinforce Southern California's gas system are the following:

(1) Installation of thirteen miles of 22-inch pipeline from Newhall north; cost, $348,000.

(2) Installation of an additional seven miles of 10-inch pipeline north of Kettleman Hills; cost, $77,000.

(3) Installation of five miles of 12-inch pipeline from Ten Sections to Greeley; cost, $60,000.

(4) Connecting the two gathering systems in Semi-Tropic field, requiring six miles of 8-inch pipeline; cost, $39,000.

(5) Installation of 7,500 feet of 6-inch pipeline from Tejon field to the Taft-Los Angeles transmission lines; cost, $6,500.

(6) Installation of additional compressor capacity at Hollywood Station; cost, $75,000.

(7) Installation of additional compressor capacity, and rearrangement of existing piping, at Pasadena Station; cost, $130,000.

(8) Installation of additional compressor capacity at Slauson Station; cost, $70,000.

(9) Additions and betterments to the Brea compressor station; cost, $21,000.

(10) Installation of a 250,000 cubic-foot capacity high pressure storage holder at Palm Springs.

(11) Installation of two 250,000 cubic-foot capacity high pressure storage holders at Redlands.

(12) An extensive building program.

(13) Installation of four holders at Claremont, Azusa, Covina, and Glendora, giving additional storage capacity of 1,000,000 cu. ft.; cost $160,000.

(14) Construction of a standby butane plant at San Pedro; cost $130,000.

According to R. M. Bauer, gas supply supervisor, Pacific Lighting Corp., controlling company, more wildcat wells are being drilled than ever before. Many new fields—Greeley, Ten Sections, Buena Vista Lake, Tejon, Semi-Tropic, McDonald Island, Rio Vista, El Segundo, and Wilmington—have been discovered; deeper zones in the proven fields of Kettleman Hills, North Belridge, Elwood, Inglewood, W. Coyote, Dominguez have been developed; extensions to existing fields —North Belridge, Ventura Avenue, Montebello, Huntington Beach—have been explored.

On October 15 the gas companies of Southern California were connected to 16 Los Angeles basin fields, 9 coastal district fields, and 14 San Joaquin fields. During the severe cold spell last January they were able to deliver 475,000,000 cubic feet daily to the Los Angeles metropolitan area, and now they are able to increase this volume to 500,000,000 cubic feet daily.

■ ■

A. G. A. E. M. Direct Heat Division Meets Dec. 2

Promotion and merchandising plans for 1938 will be discussed by members of the Direct Heating Equipment Division of the Association of Gas Appliance and Equipment Manufacturers at a conference to be held December 2 at Netherland Plaza Hotel, Cincinnati, Ohio.

R. F. Cleary, secretary of the Homestead Heater Co., Newark, N. J., will preside at the sessions at which marketing and statistical trends will be considered. The Division's participation in the gas industry's exhibit at the New York World's Fair in 1939 will also be outlined.

■ ■

Mystery Chef's Broadcast Extended to May, 1938

Regional Advertisers, Inc. of New York, sponsors of the Mystery Chef radio program, announce that contracts have been signed with the Mystery Chef, the National Broadcasting Co. and McCann-Erickson, Inc., for continuation of the present series of broadcasts until May 26, 1938. Seventy-eight companies having in service 5,772,722 meters will participate.

■ ■

Booster Station in Depew

To boost the pressure of wells in the Depew field, Oklahoma, so that it can be turned into the main lines, The Cities Service Gas Co. is building in the field a booster station having three 80-hp. gas engines and compressors.

The Goodman Stopper

The Reliable Shut-off for Street Mains

Equipped with Improved Patented Locking Sleeve, which locks both handles to the pipe. Stopper cannot slip. Gas cannot pass.

Safety Gas Main Stopper Co.
523 Atlantic Avenue, Brooklyn, N. Y.

Pac. Coast Rep.: C. B. Babcock Co.
475 Eleventh Street
San Francisco, California

SAFETY FIRST!!

METALBESTOS GAS VENT AND FLUE PIPE

Is Now Approved and Listed Under the Re-Examination Service of

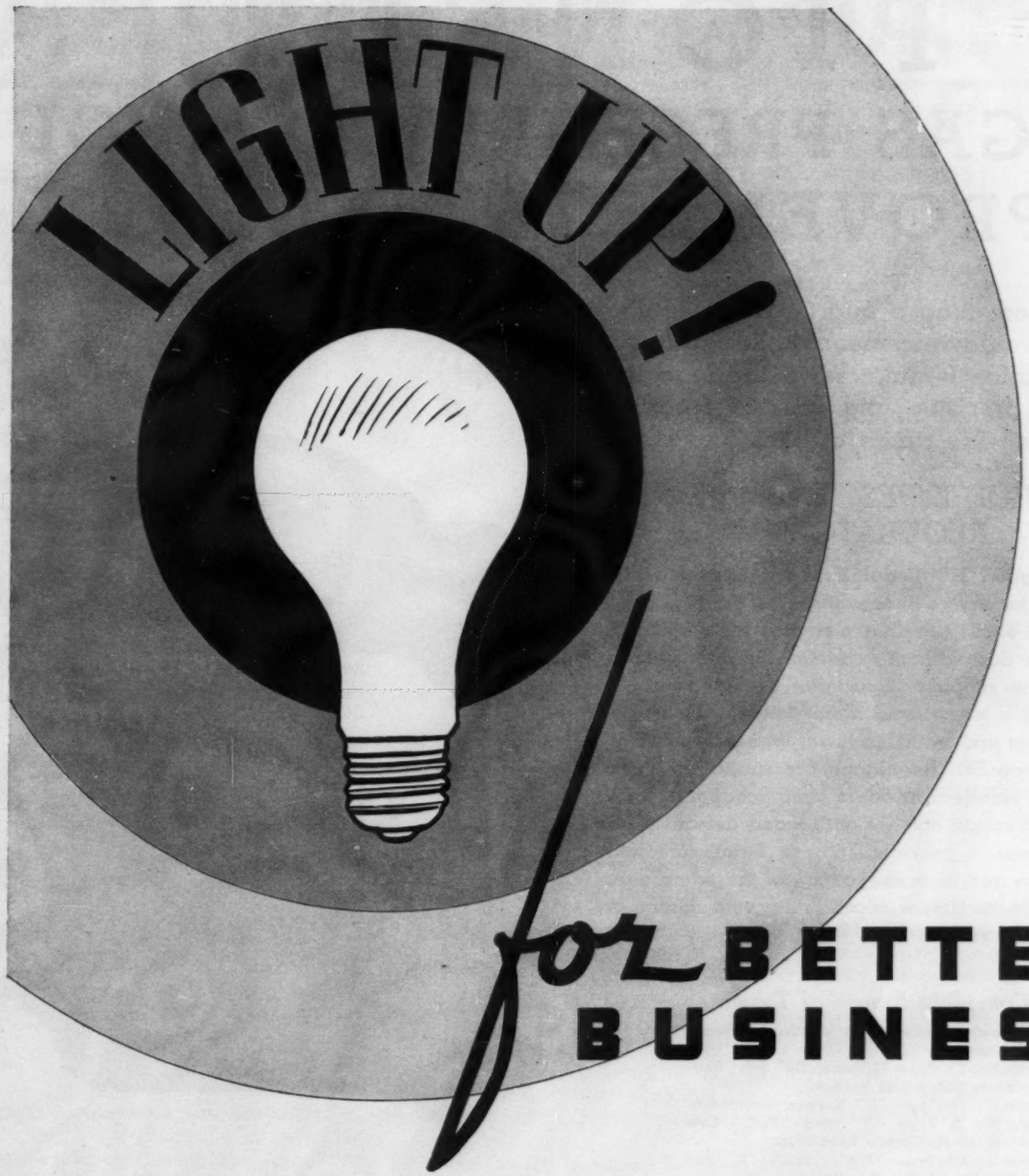
UNDERWRITERS' LABORATORIES INC.

All pipe and fittings hereafter leaving our factory will bear the prescribed marking of the UNDERWRITERS' which will be your assurance of SAFETY, UNIFORMITY and DURABILITY.

Manufactured with Pardonable Pride by

WILLIAMS-WALLACE COMPANY

160 HOOPER STREET SAN FRANCISCO, CALIF.



Profit-minded storekeepers are fast awakening to the selling power of modern lighting. Observe the thousands of new storefronts, the better lighted interiors, counters, showcases.

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RELIANCE REGULATORS

The Construction of Pressure Loaded Regulators

By J. V. THOMAS

Vice-president, Natural Gas Equipment, Inc.*

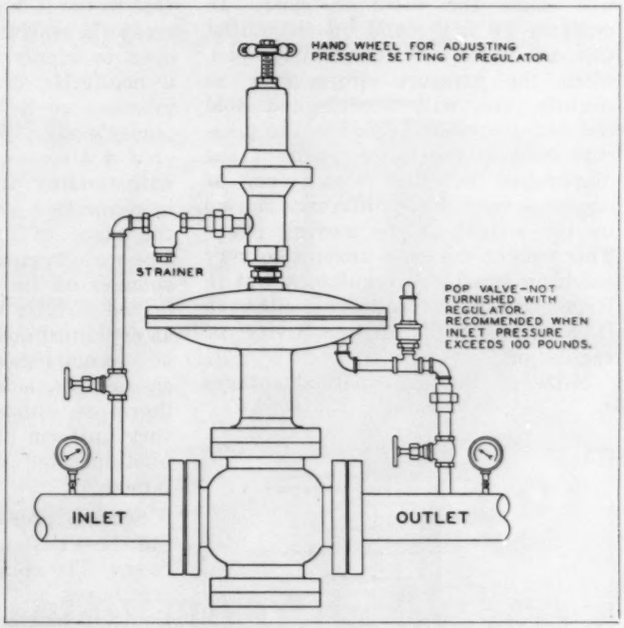
HAND WHEEL FOR ADJUSTING PRESSURE SETTING OF REGULATOR
STRAINER
POP VALVE—NOT FURNISHED WITH REGULATOR. RECOMMENDED WHEN INLET PRESSURE EXCEEDS 100 POUNDS.
INLET
OUTLET

FIG. 1
Installation of Pressure Loaded Reducing Regulator

WHEN spring-loaded regulator construction was adopted by many of the regulator manufacturers, it was rumored that this spring mechanism which seemed most suitable for many of their then modern control problems would completely eliminate the weight-loaded design. This, as we all know, proved false and today there are still many weight-loaded regulators manufactured which are highly satisfactory for the particular purpose for which they are designed.

J. V. THOMAS

As a parallel to this, the pressure-loaded regulator is now the object of considerable exploitation as a major improvement in diaphragm regulator design. Pressure-loaded regulation, although not basically new, has been found to possess superior qualities, for certain applications, as compared with the more common weight and spring methods of design. It is not intended therewith to convey the impression that pressure-loaded regulators will ultimately replace spring or weight-loaded types for all service. Instead, pressure loading proves to be a specialist, as it were, in a certain field of control.

The following is primarily devoted to this particular field of control together with features of design and construction and method of operation, omitting insofar as possible, reference to any of the other worthy modern developments in control, of which there are many.

A so-called "pressure-loaded regulator" is a diaphragm-actuated valve with one side of its diaphragm connected to the pressure to be controlled, and the opposite side connected to an adjustable pressure source capable of maintaining a constant pressure automatically. This constant pressure constitutes the loading or pressure setting of the regulator in place of spring tension or weights. Substituting this loading pressure for springs or weights considerably simplifies the construction of the regulator assembly.

Pressure Loaded Reducing Regulators

The simplest form of pressure loaded regulation and the one most generally used by all regulator companies is the pressure loaded reducing regulator, as shown in Fig. 1. The actuating pressure or reduced pressure connection to the diaphragm can be made either through a small pipe from the outlet side of the regulator to the under side of the diaphragm, or this connection may be eliminated if sufficient opening is provided around the valve stem, to permit the outlet pressure to reach the diaphragm through the space around this stem. In either event, a suitable pop-valve should be installed particularly where high inlet pressures prevail. This will protect the large low pressure diaphragm housing against undue strain in cases where the high pressure may build up on the outlet side, as often happens when a valve is closed on the outlet side of the regulator.

The installation drawing shows the pilot supply pressure coming from the inlet or upstream side. This is the most satisfactory hook-up because the inlet pressure being always higher than the outlet pressure assures a dependable source of pilot supply. If for any reason the inlet pressure drops below the control point on the outlet side, the regulator merely opens and becomes inoperative until an adequate supply is restored. This supply pressure instead of coming from the upstream side may be brought from some other source. However, the source must be at least slightly higher than the desired outlet or controlled pressure and its continuity must be assured.

Fig. 2 is a quarter section of the reducing regulator shown in Fig. 1. This regulator is so designed that the valve seats up; that is, to close the valve, it must travel in the direction of the diaphragm. Therefore, whenever the loading pressure on the diaphragm is increased the valve will

*Presented before the Southern California Meter Association, Huntington Park, Calif., October 28, 1937.

open and permit more volume to be passed thus increasing the outlet pressure which in turn builds up on the under side of the diaphragm opposing the pressure applied by the pilot and when equal to it or slightly greater, will cause the valve to close. In response to a demand on the outlet side, the valve will immediately open, when the pressure drops ever so slightly, and will throttle and hold the outlet pressure equal to the pressure held on the loading side of the diaphragm by the pilot, plus, of course, a very slight difference caused by the weight of the moving parts. This weight does not amount to very much on small size regulators, but in large sizes is very noticeable although it has no effect on sensitivity of regulation.

Some of the principal advantages of this control may be easily recognized. First, the elimination of a cluster of springs makes it possible for diaphragm and valve to travel over the full distance of its stroke without meeting added resistance. Due to the lack of any progressive increase in resistance, the regulator can open to supply its full capacity with a negligible drop or differential in pressure on its diaphragm. For simplicity's sake, Fig. 2 may be considered a direct operated regulator notwithstanding the hand control pilot in connection. The pilot merely takes the place of an adjusting medium. The main regulator reacts to pressure changes on its large diaphragm connected directly to its valve. However, as explained above, the full travel can be accomplished by a very slight change in actuating pressure and therefore, although direct operated, a very uniform pressure comparable to pilot operated regulation can be maintained.

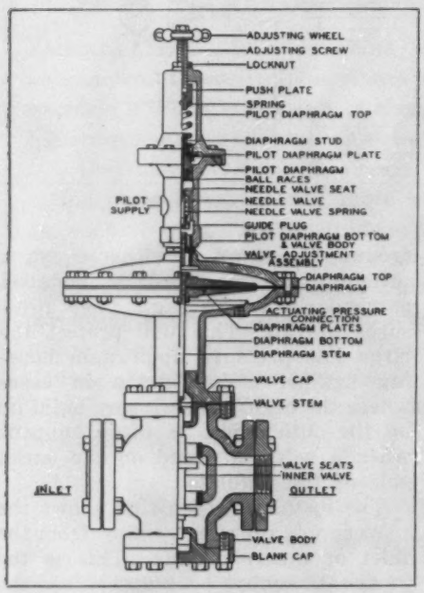

FIG. 2. Quarter section pressure loaded reducing regulator.

Second, pressure loaded regulators can be constructed without stuffing boxes. The complete absence of stuffing boxes not only eliminates friction and makes for closer regulation, but is an added importance where hazardous or toxic fluids are being handled. The greatest source of friction in regulating valves is at the stuffing box. All modern manufacturers strive to reduce stuffing box friction to a minimum. Still the danger always exists that the gland nut may be cinched down too tightly and cause binding.

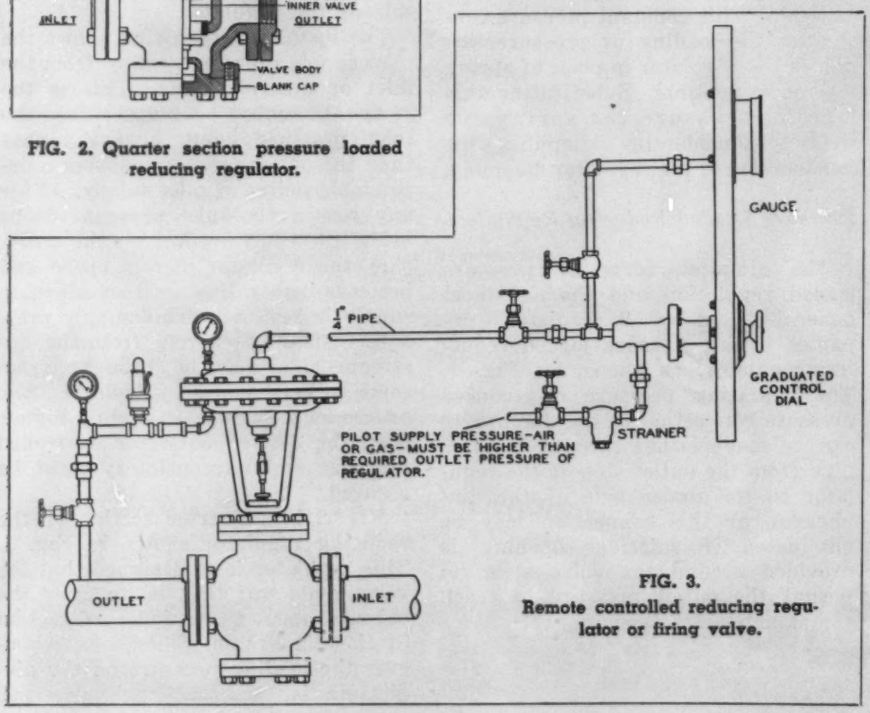

FIG. 3. Remote controlled reducing regulator or firing valve.

Third, another advantage is that diaphragm sizes can be relatively larger for high pressure operation because the only limiting factor in this connection is the strength of the diaphragm cases to withstand operating pressures, whereas in regulators where springs are employed, there are limits relating to diaphragm area determined by carrying ability of spring clusters. The larger diaphragm sizes are of considerable importance in sensitivity, power, and maximum valve travel.

Fourth, the small hand operated pilot valve for loading the regulator can be designed to give an extremely wide range of adjustment which cannot be built into spring loaded construction as readily. The range of pressure loaded regulators is dependent upon the range of the small hand control pilot which governs its loading pressure. These small pilots have a very limited capacity requirement because the only volume which they are required to handle is that volume necessary to displace the diaphragm area throughout its stroke. With such little capacity variation, a spring-loaded pilot can be designed to give extremely close control over a very wide range of adjustment. As an example of this, some pressure-loaded regulators have adjustable ranges of from as low as 5 or 10 lbs. up to 150 lbs. without the need of changing any springs or parts.

Fifth, an important advantage also is that pressure loaded regulators are basically suited for remote control. Refer here to Fig. 3 which indicates diagrammatically a remote control installation. To show variation in construction, the main regulator, unlike Fig. 2, is of the open yoke type which calls for use of stuffing boxes. There are certain installations where the main diaphragm must necessarily be separated from the main valve due to high line temperature and a consequent need for air cooling to protect the diaphragm, or due to the fact that the controlled pressure may be some other medium instead of inlet or outlet pressure. In a remote control installation such as Fig. 3, the loading pilot may be mounted at any remote point many hundreds of feet away from the main regulator, making it possible to actually change the setting or operating pressure from a distant point without the necessity of visiting the regulator. When pilot pressure is increased, the pressure setting of the regulator is automatically increased and likewise, when pilot pressure is reduced, the main regulator will automatically reduce its controlled

pressure in exact accordance with any change made by the pilot.

Pressure Loaded Firing Valve

The foregoing leads up to an ideal application of pressure-loaded regulation. An installation similar to Fig. 3 affords a perfect firing valve for any manually fired furnace. A closed yoke type of main regulator would be preferable to the open yoke type shown for reasons cited heretofore. With a pressure loaded remote control regulator, an operator can control his fires from an instrument board, or a fireman can fire a long line of furnaces or heaters from a central point. If remote control is not desired, the pilot may be mounted on or near main regulator diaphragm and there still remain many advantages over firing with a manually operated valve. It is easier to obtain the exact increment of change desired by slightly raising or lowering the regulator control point. Upstream variations in pressure are compensated for automatically by the firing control and a dependable uniform rate of firing is assured.

Pilot Operated Pressure Loaded Regulators

Pilot operating a pressure loaded regulator by using an automatic pilot in place of a hand control pilot approaches the maximum in closeness of control. Fig. 4 shows a pilot operated pressure-loaded regulator. Instead of being set by a constant loaded pressure held by a hand-operated pilot as in Fig. 2, it is operated by an automatic pilot which is also connected to the actuating or controlled pressure and gets its pilot supply from the upstream pressure or some other source, in the same manner as the hand control pilot. This type of installation has a compounding effect on the main regulator, because not only does the main regulator diaphragm respond to pressures on the outlet side of the regulator, but in addition, the pilot causes a reverse effect in pressure change on the top side of the main regulator diaphragm. The magnitude of this compounding effect may be varied within the adjustability of the pilot used. The operation of this compounded type of pressure loaded regulator is as follows:

When outlet pressure tends to increase, the main regulator diaphragm will travel upward to close the valve and prevent any further increase. Simultaneously, the actuating pressure connected to the pilot will over-

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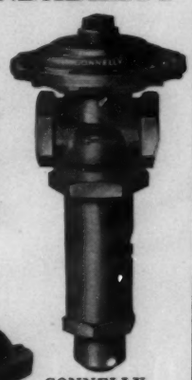

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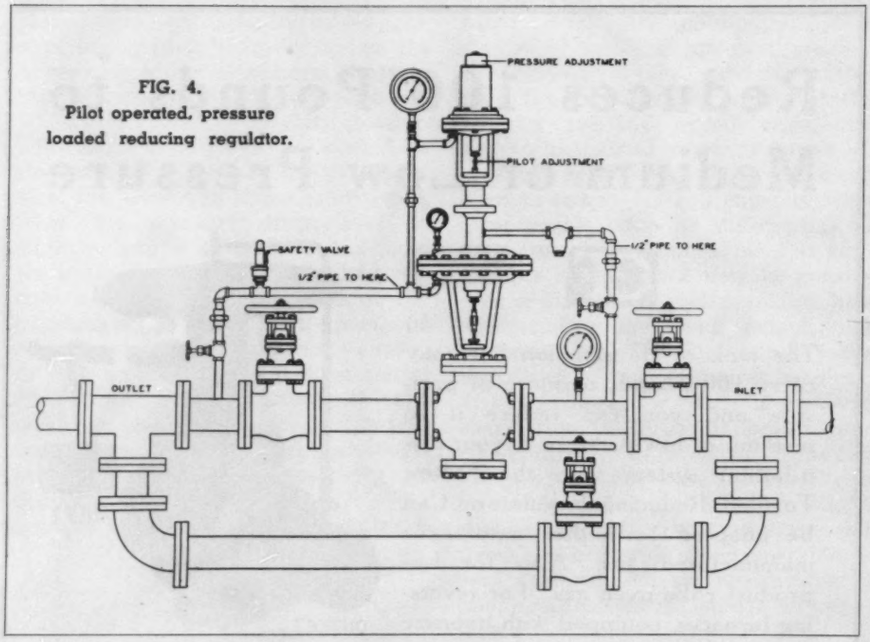
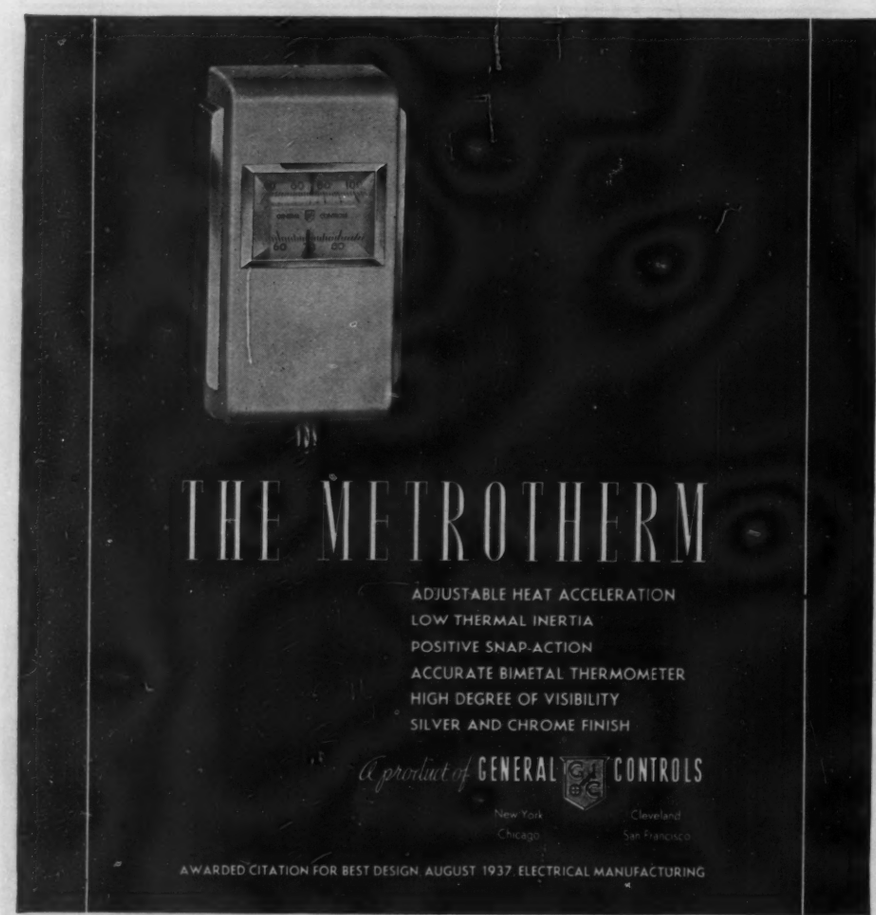


FIG. 4.
Pilot operated, pressure loaded reducing regulator.

power the spring tension above the pilot diaphragm and reduce the trapped pressure held on the upper side of the main regulator diaphragm, thus augmenting the speed with which it reacts in the closing direction and likewise increasing the closeness of control maintained by the regulator. When outlet pressure tends to decrease, pressure changes on main diaphragm are in the opposite direction and the valve opens. This type of regulator can be made to respond to one inch of water change even when operating at fairly high static pressure.



Pressure Loaded Motor Valve

Referring again to Fig. 4, it will be noted that the controlling pilot is an entirely separate part of the regulator and can be mounted at some remote point away from the main regulator and diaphram. As an example, instead of the actuating pressure of the controlling pilot being connected to the reduced pressure of the regulator, the pressure of the controlling pilot is connected to a compressor discharge line and the main regulator is installed on the compressor suction line. This type of installation is mentioned to point out the application of the pressure-loaded regulator as a motor valve. This, of course, is applicable only under certain conditions, such as where the actuating pilot responds to changes in compressor discharge pressure and increases or decreases the loading pressure on the main regulator diaphragm which in turn follows these changes immediately and exactly and increases or decreases the reduced pressure which is the intake pressure of the compressors. As the compressor discharge pressure increases, the pilot reduces the loading pressure on the main regulator diaphragm and consequently, the main regulator tends to close off and reduces the compressor intake pressure. This type of motor valve operation is entirely different from what is generally termed a "motor valve" because no attempt is made to control the increment of movement of the main valve in response to any changes in controlled pressure. The main valve is free to move in either direction at any time and therefore will respond to certain conditions to which other regulators cannot respond. For instance, should the inlet pressure to the main regulator increase or decrease while it is throttling and holding a given outlet pressure, this regulator will immediately open or close in an attempt to maintain a uniform outlet pressure and this opening or closing can take place without functioning of the controlling pilot. As a matter of comparison, an ordinary spring-loaded motor valve on an installation like this, we will say, is riding in a half-open position. With the spring-loaded motor valve, the position of its valve can only be changed by action of the controlling pilot which can increase or decrease the pressure on the diaphragm sufficiently to open or close the valve. Consequently, with an increase in upstream pressure, the main regulator will remain in half-open posi-

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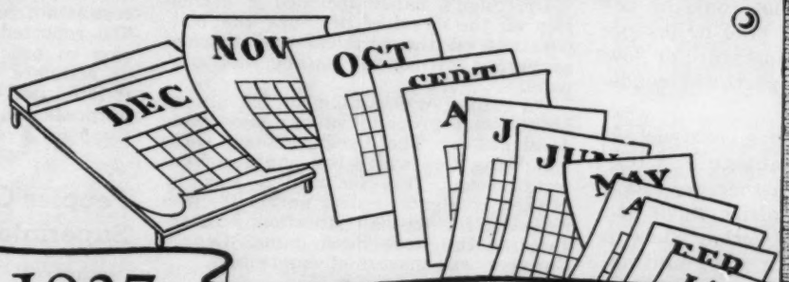

1937 IN REVIEW

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tion and more gas will pass through it, thereby increasing the compressor intake pressure. This increase in intake pressure will cause the discharge pressure to increase, which in turn, will cause the actuating pilot to change the pressure on the motor valve diaphragm and then, after a certain lag, the motor valve will react to this change. The pressure-loaded motor valve as discussed is actuated by a pressure-operated and spring-loaded pilot. However, understand that this motor valve is not limited to the above installation, nor is it limited to being controlled by the type of pilot shown but could be actuated by any type of pilot or instrument maintaining temperature or flow etc., providing other pertinent conditions were favorable.

Gradual opening valve construction has no particular advantage in a regulator of this type whether used as a motor valve or regulating valve and the very nature of its action tends to minimize overriding or hunting. Whenever this type of control can be used, the main regulator acts at all times as a direct pressure control. In so doing, the shorter the stroke necessary to accomplish a given change the more accurate and sensitive will be the result. A valve position indicator on this type of valve is usually unnecessary but is readily applicable to the open yoke type.

■ ■

Dr. B. H. Sage Addresses S. C. M. A. Meeting

"Some Properties of Normal Butane and Propane," was the subject of a paper presented by Dr. B. H. Sage, assistant professor of chemical engineering, California Institute of Technology, at the November meeting of the Southern California Meter Association, held at the Van Matre Inn, Huntington Park, Calif. on November 23.

Dr. Sage's paper included a discussion on the effect of pressure and temperature on the physical and thermal properties of normal butane and propane.

On exhibit was equipment for use on butane and propane vapors and gases developed by The Crosby Steam Gage and Valve Co., which had charge of entertainment. This included a talk by "Deke" Houlgate, sports authority, who reviewed the football situation with respect to the Rose Bowl game. George Christen was master of ceremonies.

■ ■

Col. W. F. Rockwell Abroad

Colonel W. F. Rockwell, president, Merco Nordstrom Valve Co., is inspecting the company's units in Europe.

Texas Commission Orders All Gas Accounted For

ALL Texas gas must be accounted for by measurement or estimation, according to an order of the Texas Railroad Commission, which has amended its order of May 15, 1934, requiring measurement of gas by meters when sold, but excluding gas sold for drilling purposes in the field and gas used for lease purposes.

The new order provides that gasoline extraction plants and gas pipe lines must report receipts of gas for light and fuel, oil and gas development, and gasoline extraction. Producers of gas not delivered to purchasing companies must report to the Commission.

When gas from the oil-producing process is not sold, it need not be measured and reported except when the Commission so orders. Gas may be reported on estimate instead of by measurement if it is used for temporary development purposes in the same reservoir or used for lease purposes.

■ ■

Peoples Gas Appoints Schuldt Superintendent at Central

Elmer F. Schuldt, Peoples Gas Light and Coke Co., Chicago, Ill., who won the A.G.A. Beal Medal for 1937, has been promoted from the post of assistant superintendent of Central District to that of superintendent. Mr. Schuldt succeeds Alexander H. Gillespie, who retired on November 1. Mr. Schuldt's paper which won the Beal Award was entitled "The Precision Method of Locating Gas Leaks."

George R. Boddeker has been appointed assistant superintendent of Central District. He was formerly a junior engineer.

■ ■

California Natural Gasoline Association Holds Meet

The California Natural Gasoline Association held its twelfth annual fall meeting on November 16 at the Ambassador Hotel, Los Angeles, Calif.

Dr. Lester C. Uren, professor of petroleum engineering at the University of California, addressed the afternoon session on the subject, "Present Trends and Future Prospects of the Natural Gas Industry in California." Henry N. Wade, president of Parkhill-Wade, Inc., delivered a paper on "Polymerization."

More than 800 attended the banquet and entertainment in the evening.

■ ■

American Meter Co. Elects President Payne Treasurer

F. H. Payne, president of American Meter Co., has been elected also to be treasurer of the corporation, thereby filling the vacancy created in that office by the death of Donald McDonald.

The vacant office of secretary was filled by the election of John Van Norden, formerly assistant secretary. Mr. Van Norden also was elected assistant treasurer, and will be in resident charge of the New York general offices at 60 East 42nd street. He will continue his duties as manager of sales promotion.

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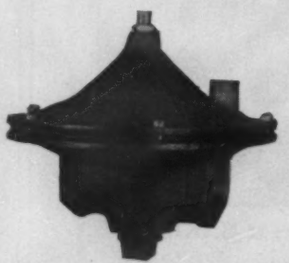

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BUTANE-PROPANE NEWS

Underground Systems Group Plans Affiliation with N. B. G. A.

LAST month in Dallas, Texas, a meeting was called by Ellsworth L. Mills, vice-president of The Bastian-Blessing Co., to discuss and decide ways and means of setting up an organization properly representative of that part of the liquefied petroleum gas industry known as the Underground Systems Division. From closer co-operation between the members of the Underground Systems Division and from a pending affiliation agreement between the Division and the National Bottled Gas Association,* it is hoped that the industry can not only demand of its members uniform safety practices, but also acquire a voice in the preparation and promulgation of the laws imposed upon the industry by various governmental agencies.

E. L. MILLS

At the Dallas meeting the work of building the Underground Systems Division and of framing the affiliation agreement fell to an organization committee consisting of the following men active in the various phases of the liquefied gas industry.

Distributors of complete systems: Chairman, H. C. Pittman, Automatic Gas Co., Tyler, Texas; vice-chairman, J. Woodward Martin, Lone Star Gas Co., Dallas, Texas.

Tank manufacturers: Chairman, E. H. Gill, Columbia Steel Tank Co., Kansas City, Mo.; vice-chairman, L. J. White, Southern Steel Co., San Antonio, Texas.

Gas manufacturers: Chairman, R. M. Stephens, Humble Oil Co., Houston, Texas; vice-chairman, George Bach, Skelly Oil Co., Kansas City, Mo.; alternate, G. L. Brennan, Phillips Petroleum Co., Detroit, Mich.

Equipment manufacturers: Ellsworth L. Mills, The Bastian-Blessing Co., Chicago, Ill.

It was the decision of the organization committee that the Underground Systems Division could best be served from the standpoints of economy and efficiency by joining forces with the National Bottled Gas Association.

In attendance at the Dallas meeting were Frank R. Fetherston, secretary, and Walter Verkamp, president, of the National Bottled Gas Association. Upon the decision of the organization committee of the Underground Systems Division to seek membership with the National Bottled Gas Association, Mr. Fetherston was invited to explain the position and functions of the Association.

After discussion and a meeting between the Underground Systems Division organization committee and Messrs. Verkamp and Fetherston, it was recommended that revisions in the constitution and by-laws of the National Bottled Gas Association be designed to give the Underground Systems Division a fair representation in the Association. It was further recommended that a schedule of dues consistent with the needs of the Association and the nature of the Underground Systems be adopted, and that all members be allowed to vote by mail.

Under the proposed new set-up, the executive board of the National Bottled Gas Association would consist of 16 members, representation to be apportioned in the following manner:

Distributors (underground systems), three; distributors (aboveground systems), three; gas manufacturers (underground systems), three; gas manufacturers (aboveground systems), three; tank manufacturers (A. S. M. E.), one; cylinder manufacturers (I. C. C.), one; appliance manufacturers, one; equipment manufacturers, one.

Under the proposed organization plan, it was provided that a president and two vice-presidents be elected by the executive board from its own number. A method that will permit nomination and balloting for each of the 16 executive board members by each member of the Association was included.

A radical change in the set-up of membership and dues was recommended. Any distributor of complete systems and any manufacturer of gas, tanks, cylinders, equipment, or appliances may become a regular association member. Dues are to be paid on gross annual sale of products used in or by the liquefied petroleum gas industry.

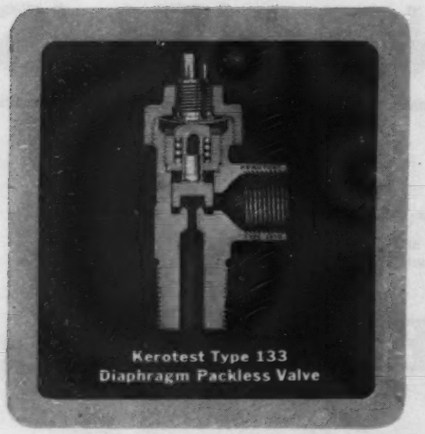
The organization committee's report was unanimously approved, and an application for membership, conditional upon favorable action by the National Bottled Gas Association, was signed by those present.

As some of the attending delegates felt that there was further need for discussion of local problems, a Southwestern Section was formed. H. C. Pittman, Automatic Gas Co., Tyler, Texas, and Milton J. LaDue, The Bastian-Blessing Co., were elected president and secretary respectively of the Section.

Upon the suggestion of Harry Newall, chairman of the committee on gases of the National Fire Protection Association, a contact committee was formulated with membership as follows: H. C. Pittman, Automatic Gas Co., Tyler, Texas; J. Woodward Martin, Lone Star Gas Co., Dallas, Texas; B. B. Stroud, Atlantic States Gas Co., New York; L. J. White, Southern Steel Co., San Antonio, Texas; Ellsworth L. Mills, The Bastian-Blessing Co., Chicago.

During the afternoon of the first day's session a discussion of technical

*In an effort to broaden its field, the National Bottled Gas Association started action several months ago to change its name to the Liquefied Petroleum Gas Association.



KEROTESTS
the ideal valves for modern propane gas service

Incorporating the famous Kerotest Diaphragm Packless design, these strong, pressure-tested valves can be inspected or repaired while under full pressure without interrupting service from the line—thus extending their service indefinitely. They are listed as standard by the Underwriter's Laboratories and are available with or without handwheels. Try them on your next job.

KEROTEST MANUFACTURING CO.
PITTSBURGH, PA.

problems of the industry was conducted by A. J. Bommer, southern representative of the Underwriters' Laboratories. During the morning session of the second day Olin Culberson and Ralph S. Orme of the Texas Railroad Commission were featured speakers.

The meeting was well attended, more than 100 representatives of 60 companies being present. Men were in attendance from the states of Texas, Louisiana, Oklahoma, Mississippi, Kansas, Tennessee, Missouri, Kentucky, Ohio, Colorado, Florida, New Mexico, California, Illinois, and New York.

At the conclusion of the meeting a rising vote of gratitude was extended to Ellsworth L. Mills, who gave unstintingly of his time, energy, and money to promote the Dallas meeting.

A meeting of the executive board of the National Bottled Gas Association has been called for December 6 in St. Louis, Mo. The affiliation with the Underground Systems Division will be further discussed at this meeting.

■ ■

Kenneth R. Kingbury Dies

Kenneth R. Kingsbury, president of Standard Oil Co. of California since 1911, died on November 22 on board a passenger steamer in the Panama Canal Zone.

Bupane Gas Co. Opens Display Department

BUPANE Gas Co., Cedar Rapids, Iowa, has opened its own art and display advertising department, following a marked increase in new business and gas volume resulting from an extensive advertising campaign started last year. C. L. Wolfe is in charge of the new department and Miss Grace Barker is artist and designer.

The campaign started with a radio program, according to Otto A. Kohl, head of the company. This year the company provided extensive display merchandising helps for dealers, also roadside advertising which showed consumers where to obtain what had been featured in radio and other advertising.

Several company stores have been opened and others are to be started in towns where satisfactory dealer representation cannot be arranged. A noticeable swing from kerosene to automatically controlled gas refrigeration has occurred in the company's territory, according to Mr. Kohl.

■ ■

France Considers Bottled Gas As Motor Fuel in Shortage

Compressed gas for use as motor fuel is attracting special attention in France, according to reports from that country. The nation imports gasoline—one of the few commodities in which it is not self-supporting—and faces the necessity of solving the problem of motor transport if the gasoline supply should be stopped.

The bottled gas used for motor fuel is found in a natural state in southern France. It has been put to wide use for other purposes where there is no town supply of gas.

■ ■

New Book on Sales Methods

"How to Increase Your Sales" is the title of a book just published by the Porcelain Enamel Institute. Written by an authority on the preparation of sales manuals, its 92 pages are filled with information, which, if followed by any salesman, should, the Institute's announcement states, result in greater sales of everything from a coffee pot to a major appliance.

■ ■

Fluor Cooling Tower Bulletin

A new and up-to-date bulletin on cooling towers has just been issued by the Fluor Corp. of Los Angeles, Calif. Superseding their smaller bulletin No. T-236, the new bulletin contains augmented tables, charts, installation diagrams and other data for engineers interested in cooling tower construction.

■ ■

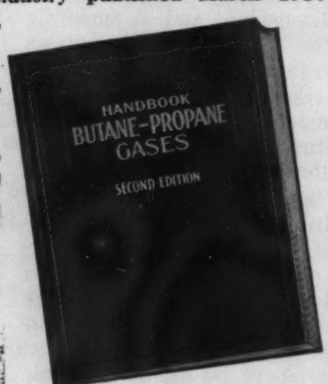
Plan Natural Gas for Yankton

Natural gas will probably be introduced in Yankton, S. D., when South Dakota Public Service Co. completes purchase of the Yankton Gas Co. According to H. G. Pelsue, local manager of Public Service, it is hoped to bring natural gas from the pipe line 24 mi. away owned by Northern Natural Gas Co.

The SUPPLEMENT to the Handbook Butane-Propane Gases (2nd edition).. **1.00** Per Copy

A record of the past two years of progress in the *Liquefied Petroleum Gas Industry* published March 1937

HANDBOOK
BUTANE
PROPANE
GASES



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GAS
The NATURAL Gas Magazine

810 S. Spring St.
Los Angeles, Calif.

Laclede Celebrates Century Of Gas in St. Louis

THE Laclede Gas Light Co., St. Louis, Mo., marked a century of gas service in the city with a ten-day celebration. Open house was held each evening at the company offices, special store and window displays were featured by the gas company and dealers, and home service demonstrations were presented. Newspapers featured the history of the company and of the discovery of gas, also the development of modern appliances.

The first gas company in St. Louis was incorporated in 1837. The Laclede Gas Light Co. was incorporated in 1857. The company was a pioneer in the use of district governors for delivering gas into a low-pressure system for domestic use. Natural gas was piped 450 miles to the city from the Monroe fields in Louisiana and the city was first served with artificial gas in 1932.

George H. Schlatter, sales manager of the company, directed the centennial.

■ ■

C. J. Reilly Made A-B Stove California Representative

C. J. REILLY

Ross Lynn, sales manager of A-B Stoves, Inc., Battle Creek, Mich., has announced the appointment of Charles J. Reilly as California representative for A-B Stoves. The California concern, which will be known as the A-B Stove Sales Co., has established warehouse stock in Los Angeles at 1001 E. 1st Street, according to the company anouncement.

For many years Mr. Reilly was the western representative of Moore Brothers, Inc., of Joliet, Ill. He has been actively identified with the gas and gas appliance industry for the past 15 years.

■ ■

Sabinal Lets Contract For $30,000 Butane Plant

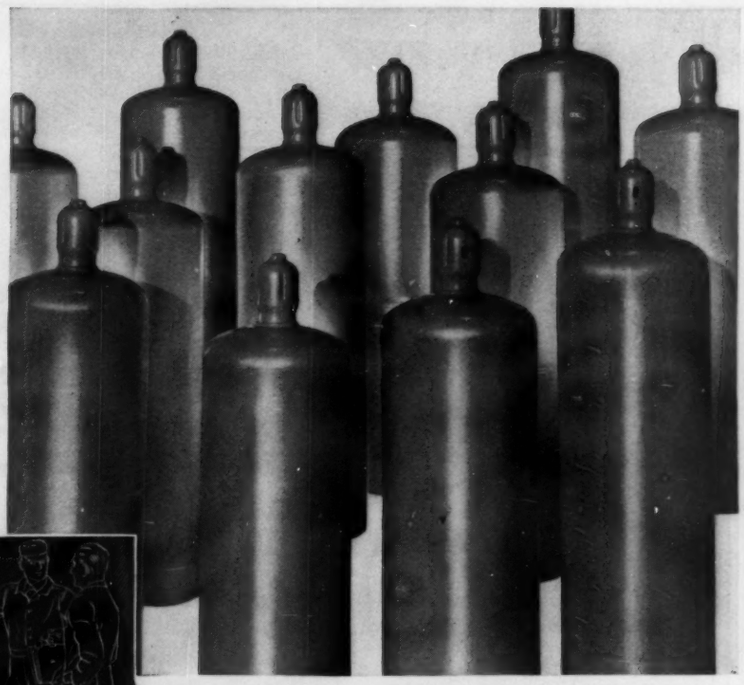
Contracts for a $30,000 butane-air plant for Sabinal, Texas, were to be opened on November 30, and the plant is to be completed in about 60 days, according to Mrs. R. B. C. Ware, city secretary. A $35,000 bond issue proposal was carried at the polls on October 11.

Approximately 250 meters will be served eventually, it is estimated. The city will not sell appliances. Gas of 550 B.t.u. will be served. It will be odorized.

■ ■

Butane Company in Grenada

A 10,000-gal. capacity storage tank has been installed in Grenada, Miss., by Butane Gas System Co., serving territory in Mississippi with Yurown gas, a straight butane, 3200 B.t.u. A fleet of trucks delivers gas to individual underground tank systems. The company carries ranges, and space and water heaters, as well as other appliances. P. H. Youngblood heads the company.



Satisfactory Service is Assured By HACKNEY Uniformity

- The uniform dependability of Hackney cylinders is maintained by precision manufacturing. Uniform capacity and the proper balance between strength and light weight provide maximum shipping and handling economies.

These are but a few of the reasons why Hackney cylinders continue to be specified year after year, by satisfied users. Write for complete information about Hackney cylinders, tanks, drums, barrels and special shapes for **your** particular needs. There is no obligation.

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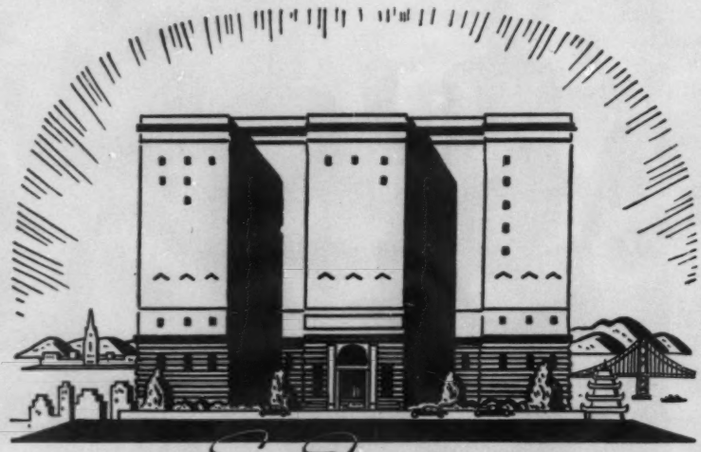
Containers for Gases, Liquids and Solids

U. S. SUPER de LAVAUD CAST IRON PIPE

"Cast without chill in a metal mold"

U. S. PIPE AND FOUNDRY COMPANY
Burlington, N. J.



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YOU CAN DRIVE YOUR CAR RIGHT INTO HOTEL SHERMAN ★★★

A.G.A. Restaurant Display Outnumbers Competing Fuels

A LARGE volume water heater, Electrolux refrigerator, and 34 other gas-fired restaurant appliances were displayed at the National Restaurant Association convention and exhibit, Chicago, contrasting sharply with only 14 exhibits of appliances using other fuels, according to an A.G.A. announcement. The gas appliance exhibit was sponsored by the Industrial Gas Section of the American Gas Association in co-operation with The Peoples Gas Light & Coke Co., Chicago. The exhibit was organized by the Industrial Gas Section's Committee on Displays at National Industrial Expositions. H. A. Sutton, Public Service Electric & Gas Co., Newark, N. J., is chairman of the committee, and T. J. Gallagher of The Peoples Gas Light & Coke Co. is vice-chairman. The gas booth, which served as an information center on gas fuel and gas cooking appliances, was under the direct charge of Mr. Gallagher.

■ ■

Crosby Steam Gage & Valve Appoints C. J. Yost

The Crosby Steam Gage & Valve Co., Inc., has announced the appointment of Charles J. Yost as sales representative for the state of Washington, with offices at 4404 White Building, Seattle. Mr. Yost, a graduate of the University of Pennsylvania, has spent a number of years in production and factory maintenance work.

Offices and complete warehouse stock, together with repair and latest testing equipment, is maintained by the Crosby Steam Gage & Valve Co. at Los Angeles. The entire Pacific Coast and western states will be supplied from this office. San Francisco sales representative for the company is the Pacific Sales Development Co.

George H. Christen is Pacific Coast manager for the Crosby Steam Gage & Valve Co.

■ ■

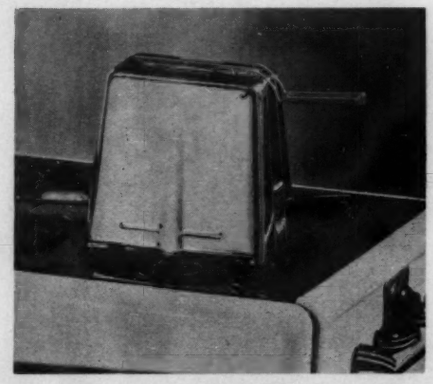
A. L. Covill Retires From Northern Equipment Co.

Northern Equipment Co., Erie, Pa., has accepted the resignation of Alden L. Covill, Rochester representative for the Copes System of boiler feed control and allied equipment. Mr. Covill is retiring from business. The Rochester territory will hereafter be covered by Charles A. Randorf, 220 Delaware Avenue, Buffalo, N. Y., who has represented Copes in the Buffalo area for the last 13 years. His new assignment represents an extension of his former territory.

■ ■

Finish Iowa City Changeover

Iowa City (Iowa) Light & Power Co. has completed the changeover to natural gas in Iowa City which was started in August. This company is the last of the United Light Properties in Iowa to change to natural gas. The changeover, according to Roscoe E. Taylor, general manager and vice-president of the Iowa City utility, was effected in one operation. The city was divided into twelve districts for changeover purposes.



Carlier & Rahr Announces Gas Radiant Heat Toaster

A gas toaster is now being placed on the market that, its manufacturers claim, will toast one piece of bread evenly, on both sides, in half the time or less that it takes toasters using other fuels to finish two slices toasted simultaneously. The appliance is the Zephyr toaster, manufactured by Carlier & Rahr, Inc., Manitowoc, Wis.

The toaster is centered over the burner, the bread placed in a rack which is removable, and then toasted by heat radiated from solid steel reflecting plates. No air that touches the gas burner touches the toast. When the toast is finished, the entire rack with the bread in it is removed by a convenient handle, which can also be used for lifting the toaster from the stove.

Made from spot-welded steel, the toaster is copper-, nickel-, and chrome-plated to prevent discoloration from heat. The handle of the bread rack is of heat-proof composition. Baffles for intensifying the heat, unconnected conduits, toast chamber ventilation by outside vents, and other engineering principles help to insure efficient and speedy operation.

■ ■

Cities Service Gas Company To Store Gas in Empty Wells

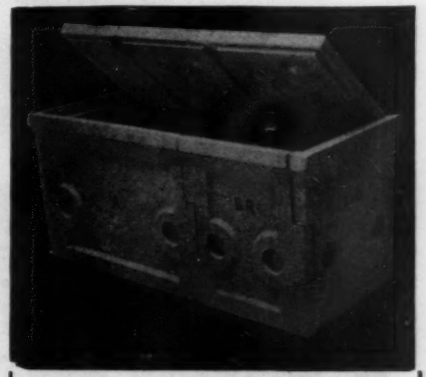
The town of Welda, Kan., has been leased by Cities Service Gas Co. for storage of reserve gas supplies in empty wells underneath the town site. The company leases property from 57 landowners, and has contracted to pay 50 cents for each 50 front ft. as yearly rental. Gas will be furnished for domestic use at 30 cents a thousand feet. The reserve supply is being established to insure more constant gas pressure during the winter.

■ ■

Bulletin on Emco Regulators

The Pittsburgh Equitable Meter Co. announces the publication of its new Bulletin 1036 describing the complete line of EMCO gas appliance regulators. The booklet shows complete specifications as to size, capacity, dimensions, etc., together with performance curves. The application for each type of regulator is clearly stated. For copies of Bulletin 1036, address Pittsburgh Equitable Meter Company, 400 N. Lexington Ave., Pittsburgh, Pa.

CURB METER Protection



with Art Concrete

Sectional Meter Boxes

THOUSANDS IN USE

Furnished in combinations suitable for single and multiple set-ups, high and low pressure. **Special features: 1—Sections resist displacement when installed and are securely locked together by concealed rods. 2—Boxes may be lengthened without removal. 3—Knock-outs are provided for pipe connections.**

. . . We also furnish curb valve boxes with break-away pipe slots and grooves for varying depths.

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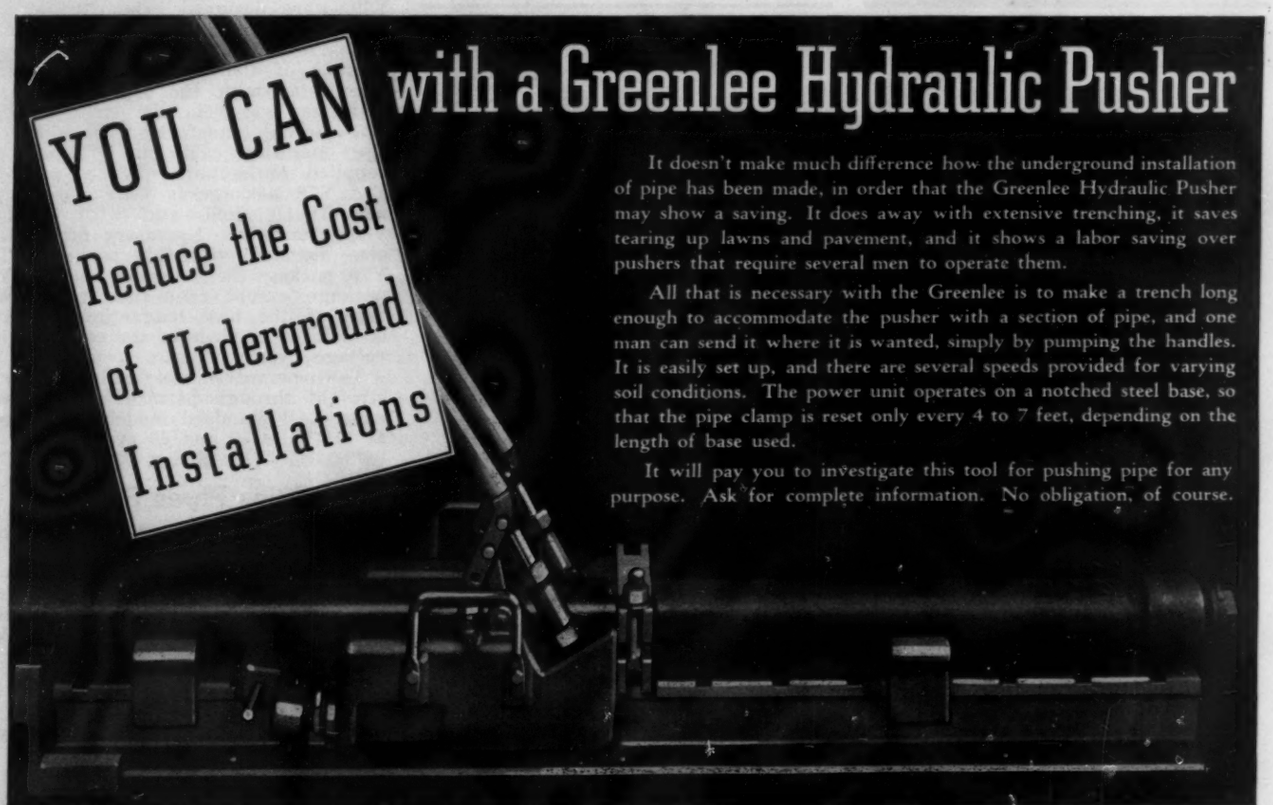

with a Greenlee Hydraulic Pusher

It doesn't make much difference how the underground installation of pipe has been made, in order that the Greenlee Hydraulic Pusher may show a saving. It does away with extensive trenching, it saves tearing up lawns and pavement, and it shows a labor saving over pushers that require several men to operate them.

All that is necessary with the Greenlee is to make a trench long enough to accommodate the pusher with a section of pipe, and one man can send it where it is wanted, simply by pumping the handles. It is easily set up, and there are several speeds provided for varying soil conditions. The power unit operates on a notched steel base, so that the pipe clamp is reset only every 4 to 7 feet, depending on the length of base used.

It will pay you to investigate this tool for pushing pipe for any purpose. Ask for complete information. No obligation, of course.

GREENLEE TOOL CO., 1700 Columbia Ave., ROCKFORD, ILLINOIS

In Los Angeles
it's the
HOTEL
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RIGHT downtown in the center of things. Easy chairs, sleep-inspiring beds, large rooms with luxurious fittings.

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Fully Automatic
INDUSTRIAL
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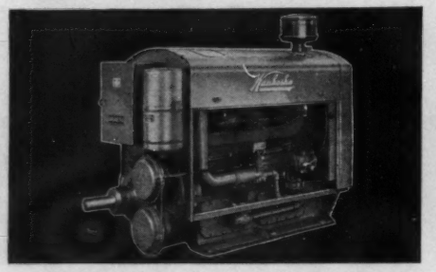
10 hp to 375 hp



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the world of ease and comfort—the genial atmosphere of the world's largest hotel. When you come to The Stevens, you'll find their stories true. This good will is the result of the constant effort of our entire staff to make the most discerning traveler feel at home.

OTTO K. EITEL, *Managing Director*

Minneapolis-Honeywell Makes New Magnetic Valve

The Minneapolis-Honeywell Regulator Co. has announced a new magnetic gas valve of the silent solenoid type designed particularly for applications where quietness, ease of installation and freedom of service are required.

The 1- and 1¼-inch size valves of the old design have been retained for these particular applications, while the new Types V345 and V835 will be offered in ⅜- ½-, and ¾-in. sizes.

These two-wire valves are also included in the new Gas Regulator Packages simultaneously introduced along with the new type magnetic gas valves. These packages, known as Y77, Y78, Y79, were designed primarily for use on floor furnaces and circulating heaters. The Y77A gas regulator package consists of the Type T45 snap-action thermostat with the new V835 magnetic gas valve in the smaller sizes. An external transformer for low voltage operation cable and fittings are supplied as a part of this package. The Y78 package is made up of the new T801A time-o-stat with the new V835 gas valve. Necessary fittings are also included with this package. The Y79 package is the same as the Y77 package except that the line voltage type of the new magnetic gas valve is included in place of the two-wire low voltage type.

The new valves are furnished only in straight through pattern with screwed ends. All standard models are offered at 110 volts 50 and 60 cycles.

■ ■

Gulf Cities Pipes Silsbee

Gulf Cities Natural Gas Co., Houston, is piping the town of Silsbee, Texas, for natural gas service and is laying a 3-in. welded line to supply the town directly from a gas well located seven miles from Silsbee. About 250 meters will be served. Silsbee is approximately 20 mi. north of Beaumont.

■ ■

Wheaton Grants Franchise

A franchise to serve natural gas in Wheaton, Minn., has been granted by the village council to C. I. Tenney Co., Minneapolis. Eight wells have been drilled in the Wheaton field and a ninth well started.

Terminal Island Prison Buys Gas From Southern Counties

NATURAL gas will supply all the fuel requirements for Uncle Sam's new penitentiary at Terminal Island, San Pedro, Calif., according to announcement from Southern Counties Gas Co. The contract which that company recently signed with the federal government calls for natural gas to supply two 300-hp. boilers, laundry heating equipment, bake ovens and ranges in the kitchens, and sundry smaller appliances.

The new prison, erected at a cost of $2,000,000, will house 650 male prisoners and 44 female prisoners when it is completed sometime around the first of the year. A place of retention for what is technically known as "short-termers"—prisoners serving from two to five year terms—the structure is considered the last word in penitentiaries. Included are such things as an auditorium, a cold storage plant surpassing any of its kind in the world, a heating plant designed specifically for the San Pedro climate, recreation rooms, workshops, school rooms, and dormitories.

Southern Counties Gas Co. is preparing also to supply natural gas for the naval flying personnel to be quartered at Reeves field on Terminal Island. Permit to cut a 400 ft. runway to lay pipe lines is pending now, and Southern Counties engineers expect shortly to make a gas connection for the temporary quarters at present being occupied by a small force. With the erection of permanent buildings, 200 men and 50 officers will be stationed at the field, which will take care of both land and sea planes.

Cooking, water heating and space heating will all be with natural gas.

■ ■

Pacific Lighting Co-ordinates Gas Supply Operations

Natural gas supply operations of the Pacific Lighting group of companies, comprising Southern California Gas Co., Southern Counties Gas Co., Industrial Fuel Supply, and Southern Fuel Co., have been concentrated under the general supervision of Roy Bauer, with headquarters at 810 South Flower Street, Los Angeles, according to a recent announcement.

ROY BAUER

All the companies involved carry on natural gas transmission operations. Under the new set-up, 810 South Flower Street, Los Angeles, is the central control point, with 1700 Santa Fe Avenue, Los Angeles, 845 Doran Street, Glendale, and the field office at Taft, designated as transmission dispatching headquarters.

E. L. Keasling continues as chief dispatcher at Southern California Gas Co. supply headquarters on Santa Fe Avenue, Los Angeles. K. B. Miller is chief dispatcher for Southern Counties Gas Co., Industrial Fuel Supply Co., and Southern Fuel Co., at Glendale, while H. Sherwood acts as field dispatcher in Taft.

R. W. Few, formerly division engineer at Avenal, has been transferred to the central office to assist Roy Bauer, now gas supply coordinator.

■ ■

Stress Specialized Appliances At Hotel Show Gas Display

Approximately 60,000 persons registered at the National Hotel Exposition in New York City, November 15-19, at which the gas exhibit, located almost at the entrance to the hall in Grand Central Palace, was acclaimed as the most striking on display. Co-operating with the Industrial Gas Section of the American Gas Association in this exhibit was the Consolidated Edison Co. of New York, Inc., and the following gas equipment manufacturers: American Stove Co.; The G. S. Blodgett Co., Inc.; Detroit-Michigan Stove Co.; Robertshaw Thermostat Co., and the Standard Gas Equipment Corp.

Most prominent features in the gas exhibit were heavy duty ranges, speed broilers of the ceramic type, deck bak ovens, and deep fat fryers. Practically all pieces were equipped with automatic temperature controls and safety pilots. The trend away from straight range cooking to cooking on specialized appliances was emphasized.

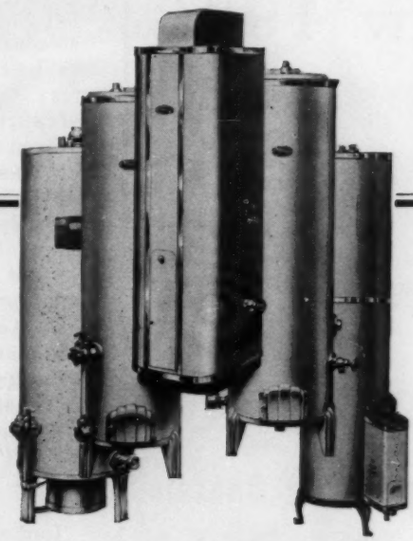
PUSH THE XMAS "GIFT APPEAL" OF

HOTZONE
Welsbach

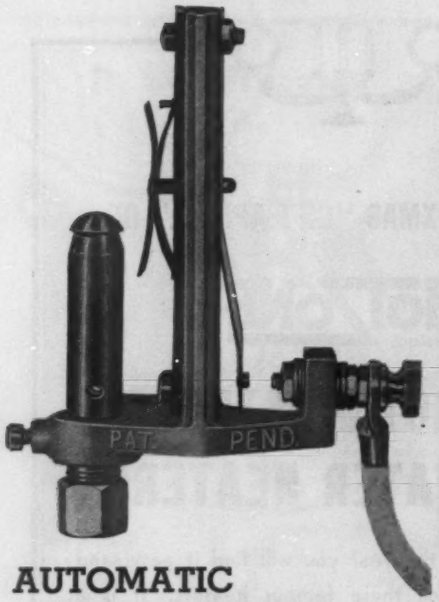
SELF-ACTION STORAGE GAS WATER HEATERS

At this time of the year you will find it easy, and profitable, to sell these famous heaters. It is a gift the whole family will enjoy during the rush of Xmas Holidays—and every day of the year. The ideal gift for members of the family to buy jointly as a surprise for either Dad or Mother. What's more, no other gift-promotion campaign will net so much in day-and-night domestic load revenue, 365 days of the year!

Promotional material available—Write for it today!



Welsbach COMPANY
Gloucester City, N.J.
BRANCHES IN CHICAGO AND SAN FRANCISCO
Since 1887, Pioneers in the Manufacture of Gas Burning Appliances



AUTOMATIC CONTACT PILOT

Works equally well with every type of remote furnace control, whether thermostat or push-button. Makes every furnace installation modern. Moderate in cost—easy to install. Write for prices and details.

◆

DOMESTIC MANUFACTURING CO.
700 East Florence Ave. Los Angeles, Calif.

New 1938 Model

The heater that SMILES while it Warms

FRASER

Radiant Front Console

Notice the modern streamline design and the two-tone walnut finish. Made in five sizes from 20,000 to 60,000 B.T.U.'s. Also available with built-in fan.

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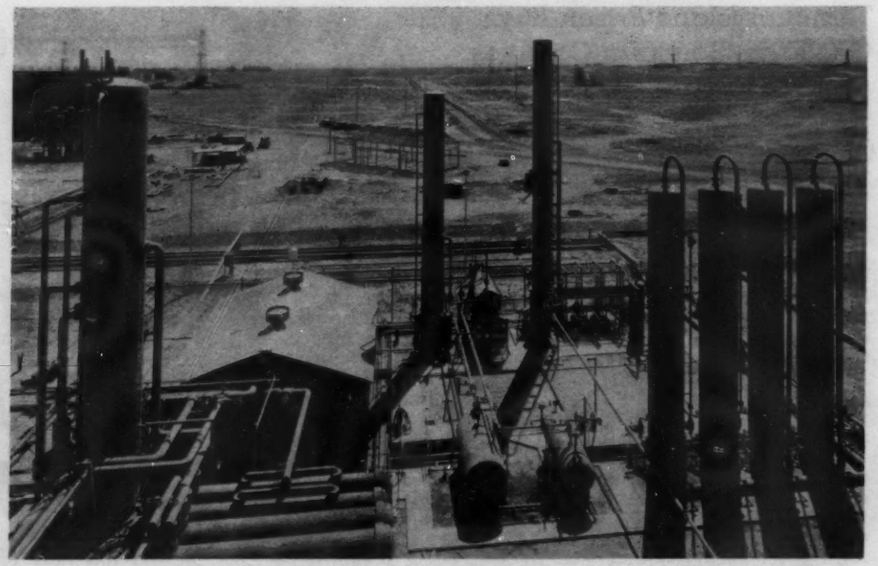


Above is a bird's-eye view of the newly completed plant taken from the cooling tower showing the placement of vessels and equipment in a comparatively small area, permitting easy access to all units.

Belridge Oil Builds New Absorption Plant

WITH a capacity of 80,000,000 standard cu. ft. of natural gas per 24 hours at 450 lbs. gage, the new high pressure absorption plant, designated as Plant 4, recently erected for the Belridge Oil Co. at North Belridge, Calif., incorporates a series of noteworthy features in its design.

From a performance standpoint, the new plant is designed for recovery of 98 per cent iso-pentanes and heavier, while the stabilizer will handle a maximum of 75,000 gals. of charge per day and make a product having a Reid vapor pressure of from 20 to 27 lbs.

Built as a turnkey job, construction was started December 15, 1936, and the completed plant was turned over to company officials on April 1, 1937. It was designed, engineered and erected by Parkhill-Wade of Los Angeles with C. L. Parkhill in charge of operations.

Immediately following completion of the new plant, Belridge officials decided to rebuild and modernize existing Plant 3 which immediately adjoins the new plant's site and Parkhill-Wade was placed in charge of the work. The erection of Plant 4 and the rebuilding of Plant 3 combine to form one of the largest expansion programs of the kind to take place in the United States during recent years.

Control of the plant is almost entirely automatic. The controls for the stabilizer are grouped on a single, centrally-located instrument panel mounted adjacent to the stabilizer unit.

All towers in the plant are of welded construction conforming to the A.P.I.-A.S.M.E. code for unfired pressure vessels. The towers rest on splayed concrete foundations having ample spread to make them stable under earthquake conditions. As a result, the plant yard is entirely free of guy wires.

Another feature employed in the plant is the method of handling piping. To eliminate the destructive corrosive action of soil, all piping is run either overhead and above ground or below the surface in open concrete-lined trenches.

Equipment installed in the plant includes a 29-bay cooling tower which incorporates a special Parkhill-Wade design having a 7-bay "hot" end and a 22-bay "cold" end with each end having its own water circuit.

■ ■

Revamp Cumberland Station

Cumberland and Allegheny Gas Co. is revamping its Thomas compressor station near Weston, W. Va. Work includes installation of high-pressure cylinders, and changing suction and discharge lines and gas after-coolers.

MAXIMUM USABILITY . . . .

NOW Demanded as the Prime TRENCHER Requirement—

found always in the

CLEVELAND BABY DIGGER—

model 95

The "COMPLETE TRENCHER"

Today's Cleveland "Baby Digger" Model 95 is the complete answer to gas line requirements. So compact and easy to handle that it affords maximum machine-usage in the crowded conditions of cities and towns and yet so rugged and powerful that it handles the most difficult digging with minimum service interruptions. Quickly and economically transported from job to job on its special trailer. Let us tell you of the many improvements built into this Model 95 Baby Digger which make it the "Complete" machine for your work. Assures most trench in most places at least cost. Don't delay. Write for details today.

THE CLEVELAND TRENCHER COMPANY

"Pioneer of the Small Trencher"

20100 St. Clair Ave. Cleveland, Ohio

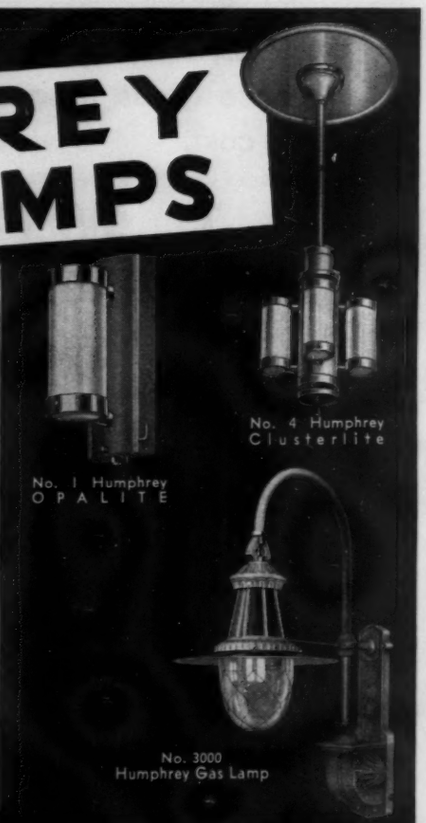
The CLEVELAND BABY DIGGER Model 95

HUMPHREY Gas LAMPS

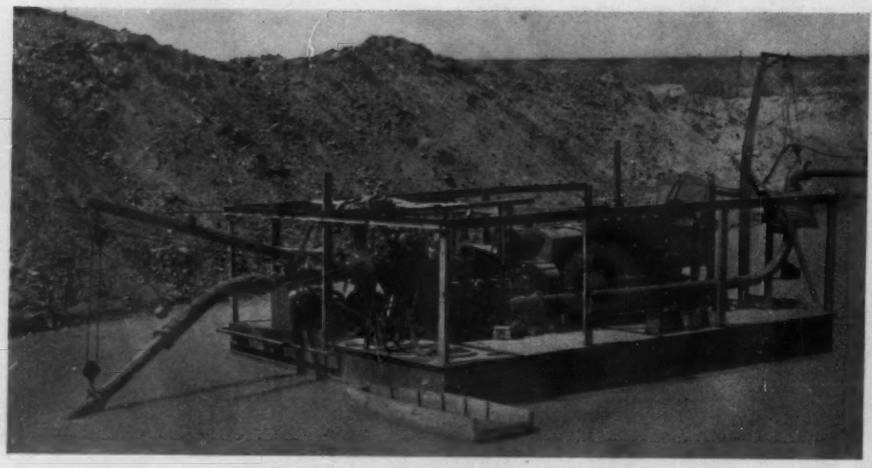
A substantial gas lighting load is at your elbow, and these new, modern Humphrey Lamps will enable you to get it. Homes, stores, factories, oil stations — all of these and countless others — are logical prospects for gas lighting.

The illustrations on this page show part of the new Humphrey Gas Lamps—the Lamp Posts, for streets and service station floodlighting; the No. 3000, for floodlighting of retail store fronts and service stations; the Opalite, for homes and retail stores; and the Clusterlite for larger interior needs.

These and other new Gas Lights—modern and beautiful, more efficient, more convenient than was ever thought possible—now provide equipment for every lighting need. Write today for complete literature and selling information.



GENERAL GAS LIGHT CO. KALAMAZOO, MICHIGAN



On the gravel dredge shown above a 150-hp. gasoline engine was converted to natural gas by the Dallas Gas Company.

Dallas Gas Co. Serves Dredge Engine

On a gravel dredge operated by the Roberts Sand & Gravel Co. The Dallas Gas Co. recently converted a 150-hp. Twin City gasoline engine to natural gas, using as a support for a 2-in. gas line the 8-in discharge line from the pump. This discharge line has three swing joints, one on the dredge and two on the shore bank to allow for flexibility in dredge operation; however, on the gas line it was decided to use a flexible hose on each end of the pipe and thus avoid any chance of leakage.

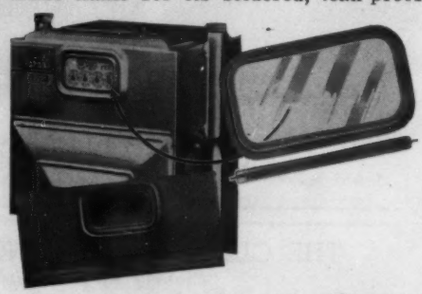
This dredge handles approximately 250 yds. per day to the screen and sizing plant, which is also powered with converted engines, making the entire plant natural-gas-engine operated.

The Dallas Co. was fortunate in having a field line within close proximity to the plant so that a very small expenditure was involved in securing a very nice all-year load which thus far has operated three months with only one service call.

■ ■

Pittsburgh Equitable Meter Co. Announces "Emcovar"

Pittsburgh Equitable Meter Co. has announced a new development of its laboratories known as "Emcovar," a trade name for its soldered, leak-proof



index box glass for tin meters. Emcovar provides a solder-sealed, leak-proof molded glass which eliminates window glass held in place with putty.

The index glass consists of a rectangular frame of Kovar metal, to which has been fused during the molding process, the glass itself, which is approximately one-fourth of an inch thick. The metal frame projects approximately one-eighth of an inch beyond the glass on all sides.

Kovar is an alloy developed to fuse with certain kinds of glass and be permanently bonded after the two are molded together. Installation of Emcovar glass consists of soldering the Kovar rim in the new one-piece gallery of the meter. The manufacturer states that because of Emcovar's greater strength, there is no necessity for using a protective lid on meters equipped with the glass. This glass has made possible a single unit of the gallery and index box, thereby decreasing the total length of soldered seam by 12 inches, with consequent elimination of possible leakage at this point.

■ ■

Starr Thayer Begins Private Corrosion Service

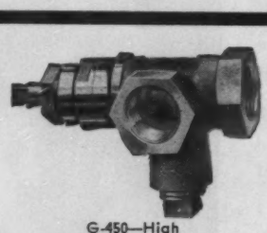
Starr Thayer, corrosion engineer of United Gas Pipe Line Co., Houston, Texas, on December 1 will launch a private corrosion and pipe line engineering service. He will continue as consultant for United on corrosion problems. His offices will be in the Rusk Building, Houston.

Mr. Thayer has been corrosion engineer with United for the past seven years. Much of the present electrical protection development was pioneered by United under Mr. Thayer's direction. In his private practice Mr. Thayer will specialize in electrical protection work, soil tests and coating recommendations, corrosion surveys of pipe lines and pipe line evaluation work for tax and rate purposes.

EXCLUSIVE design of Mueller Gas Era Furnace gives longest life—lowest operating cost.

L. J. MUELLER
FURNACE COMPANY
MILWAUKEE

GAS STOPS



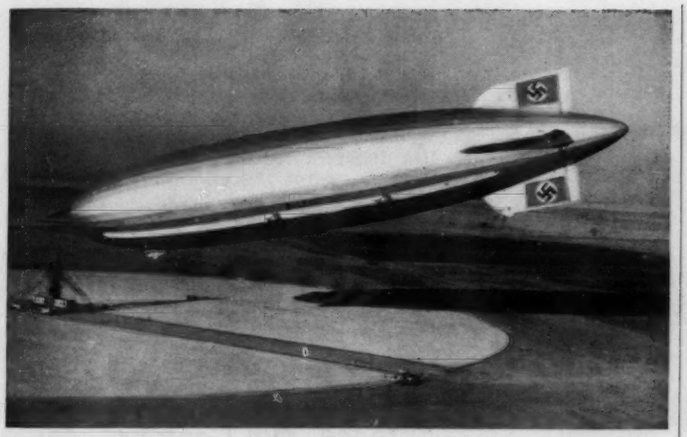
G-450—High Pressure Gas Meter Shut-off Valve

G-315—Lockwing Extra Pattern Gas Stop

"by Kitson"
Surest Guarantee of Quality for Forty Years!

KITSON COMPANY
2409-15 Westmoreland St. Philadelphia, Pa.
Kitson Safety Devices (Lovekin Patents) for Domestic Water Heaters
Quality Brass Goods for Gas, Water and All Plumbing Uses
ESTABLISHED 1897

Look for the K-CO TRADE MARK



THE ILL-FATED HINDENBURG USED *Moisture* FOR *Ballast*

MOISTURE from the exhaust was used as a ballast to keep this ship on an even keel. For every 100 lbs. of gas consumed there was formed approximately 135 lbs. of water! Approximately 87% of this *moisture was from the air*—13% from the gas. That moisture percentage is almost the same inside your chimney. BUT *in the chimney* water does a *real damage* because it is absorbed in the porous wall where it freezes and expands causing cracks. Chimney repairs are expensive and unnecessary. Install Vitroliner the Permanent Chimney Liner for Chimney Protection and the Howle Heat Extractor for Fuel Economy. *Notice the difference!*

VITROLINER
the permanent Chimney Liner

Trade Mark—reg. U. S. Pat. Off.

Please direct all Canadian inquiries to: Condensation Engineering Company, of Canada, Ltd., 196 King St., London, Ontario

Information and prices on Condensation equipment will be sent on request.

CONDENSATION ENGINEERING CORPORATION

TELEPHONE MONROE 1031

335 South Western Avenue, Chicago

LEADERSHIP

● In every line of business there is always a leader—always one company that ranks above all others in achievements, experience and quality of product. This is true in the Gas Control field. Reynolds, with forty-five years' experience, is the oldest and largest exclusive maker of Gas Control equipment.

The constant introduction of new regulators is proof of Reynolds' pledge always to improve its products. For Reynolds is not content to rest upon any past achievements. Reynolds is jealous of its position and determination to continue its leadership — to the end that Reynolds will always be the one best source of supply for Gas Control equipment.

REYNOLDS PRODUCTS

High Pressure Service House Regulators — Straight Lever Type—Models 0-10-20 series; Toggle Lever Type —Model 30 series.

Low Pressure Service or Appliance Regulators.

District Station Regulators, Single or Double Valve—Auxiliary Bowl and Automatic Loading Device optional.

High Pressure Line Regulators—Pilot Loaded—Pilot Controlled.

Toggle Type Regulators—Single Valve, Double Valve, Triple Outlet.

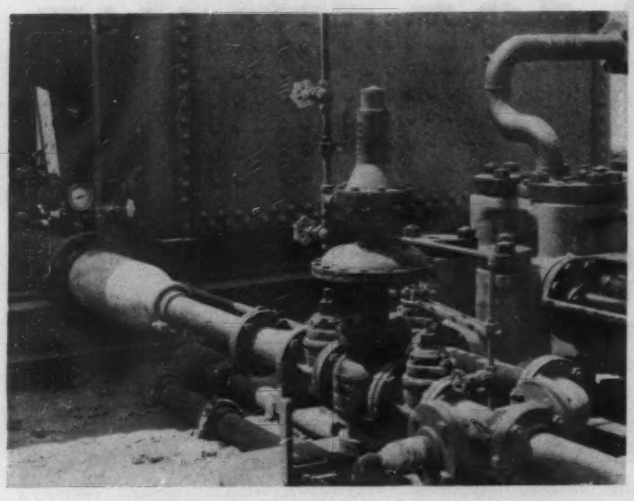
Seals—Dead Weight or Mercury . Back Pressure Valves. Automatic Quick Closing Anti-Vacuum Valves . Automatic Shut-off Valves . Lever Operated Valves . Louver Operated Device . Atmospheric Regulators . Vacuum Regulators.

● **BRANCH OFFICES:**
421 Dwight Bldg., Kansas City, Missouri.
2nd Unit, Santa Fe Bldg., Dallas, Texas.

● **REPRESENTATIVES:**
Eastern Appliance Company, Boston, Mass.
Wm. A. Ehlers, East Orange, New Jersey.

REYNOLDS GAS REGULATOR COMPANY
Anderson, Indiana, U. S. A.

GAS CONTROL SINCE 1892



AT LEFT:

Boilertrol is a combined steam control regulator and reducing valve.

Natural Gas Equipment Announces New Oil Field Boiler Regulator

ANNOUNCEMENT is made by Natural Gas Equipment, Inc., of Los Angeles, Calif., of a new regulator for automatically firing oil field boilers. This regulator is designed to meet the need for closer control of steam pressure on drilling boilers and to provide for accurate regulation of the maximum and minimum gas pressure on the burner. The Boilertrol, the name of this new regulator, is a combined steam control regulator and reducing valve.

The N.G.E. Boilertrol is described as two valves in one. It acts as a reducing valve, in addition to varying gas burner pressure in accordance with steam demands upon the boiler. Owing to its pilot-operated construction, it has great actual useable capacity, because it can open wide if necessary on a very slight steam pressure change.

The Boilertrol is pilot operated and will maintain steam pressure within 3 lbs. under extreme changes in load. The regulator is of the pressure-loaded type and will not surge, pulsate, or override. The diaphragms of the pilot, which are subjected to the steam pressure, are of Monel Metal.

Only two adjustments can be made: (a) the steam pressure setting, and (b) the maximum burner pressure adjustment.

■ ■

Bristol Bulletin Describes Furnace, Kiln Controls

A bulletin describing temperature recorders and controllers for furnaces and kilns and for industrial ovens, has just been published by The Bristol Co., Waterbury, Conn.

This bulletin contains information about Bristol's potentiometer and millivoltmeter type pyrometers and controllers, as well as descriptions of a complete line of thermometer recorders and controllers. Bristol's pneumatic and electric control valves and pyrotrol are also described. The Pyrotrol is for automatically lighting gas-fired ovens and for protection against explosions due to pilot light failure. Data are also included regarding thermocouples, extension leads, protection wells, bulbs, drilling dimensions, chart lists and scales.

A copy of Bulletin No. 462 may be obtained upon request.

■ ■

Detroit-Michigan Stove Co. Starts Sales Magazine

Utility and dealer salesmen and saleswomen who handle Detroit Jewel and Garland Ranges receive a monthly tabloid-magazine now being published by Detroit-Michigan Stove Co.

First issue of the publication, which is called "What's Going on in the Gas Industry?" was published in October. Its leading editorial, written by Advertising Manager Lee Clancy, sets forth the point that it is the retail salesman out in the firing line who develops the significant new practices in gas range selling, and states that this publication is to be a clearing house for the selling ideas of salesmen and sales managers in all parts of the country.

■ ■

Gas Replaces Oil in Schools

Twenty-two schools in San Antonio, Texas, have been converted to natural gas for heating that formerly were using oil, making a total of 26 schools now being heated by gas. Savings of $8,125 annually are estimated for the school system, which buys the gas from the San Antonio Public Service Co. at a flat rate of 15 cents per 1,000 cu. ft.

■ ■

Rapid City Hospitality Room

A hospitality room has been opened at Rapid City, S. D., by Montana-Dakota Utilities Co., where the company will demonstrate its equipment and where clubs and other groups may entertain.

Electrogas
FOR EVERY HEATING NEED
FURNACES
BLOWERS
FILTERS
WASHERS
Air Conditioning • Heating Equipment
WRITE FOR ATTRACTIVE DEALER PROPOSITION
ELECTROGAS Division of Payne Furnace & Supply Co., Inc.
2575 BAYSHORE BOULEVARD, SAN FRANCISCO

BASO
THERMO ELECTRIC SAFETY CONTROL FOR GAS BURNING APPLIANCES
BOILERS ★ FURNACES ★ CONV. BURNERS ★ SPACE HEATERS ★ UNIT HEATERS ★ AIR CONDITIONERS ★ OVENS ★ RANGES ★ WATER HEATERS, ETC.
MILWAUKEE GAS SPECIALTY CO.
MILWAUKEE ★ WISCONSIN
GAS VALVE SERIES 500
ELECTRIC SWITCH SERIES 600

Take Gas into

The Living Room

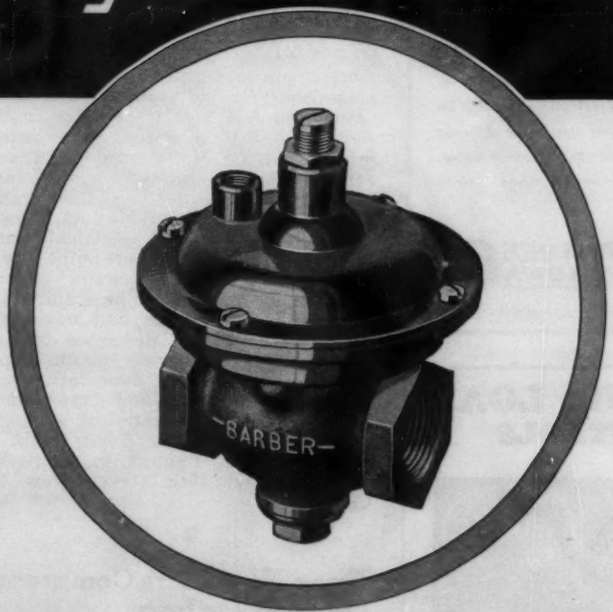
with a

HUMPHREY
Radiantfire-Mantel

LIFE takes on a new significance when the family is grouped around a glowing Radiantfire-Mantel. Grandpa dozes and re-lives the glorious days of his youth. Dad stretches his legs and relaxes. Mother smiles at the antics of the children playing on the floor. Here is GAS DRAMATIZED! Here is convincing evidence of the ability of Gas to contribute to human comfort and contentment. A Radiantfire-Mantel costs so little ... but means so much. Take Gas into the living room and it will be welcome everywhere. Write for complete information.

GENERAL GAS LIGHT CO. KALAMAZOO, MICHIGAN

Regulators offer You a Market for More SALES!



Made in the following sizes: ¼", ⅜", ½", ¾", 1", 1¼", 1½", 2"

Every retail customer, on sales, installation, or repair of furnaces, boilers, heaters, kitchen ranges, water heaters—in fact ANY GAS Appliance for home, industrial or commercial use—is a potential buyer of a Gas Pressure Regulator. Point out to these people the assured fuel savings, the greater safety, the all-round satisfaction, of equipping either the line or the appliance with a Regulator. You'll be surprised at how easy it is to make the additional PROFIT on this *necessary* equipment. For perfect results—be SURE it's a BARBER Regulator!

Many Gas Appliance makers have adopted the Barber Regulator as a standard accessory—they like its *eye-appeal*, an appearance in keeping with modern design in heating equipment.

Built to Barber standards of precision, carefully inspected, gas-tested for operation within a range of 3/10 pressure drop. Attractive, compact, design, all-bronze body. A. G. A. approved (¼" to 1½" sizes). Priced for *profit to you!* Write for catalog and price list on Barber Burner Units for Gas Appliances, Conversion Burners for Furnaces and Boilers, and Regulators.

THE BARBER GAS BURNER CO., 3704 Superior Avenue, Cleveland, Ohio

BARBER GAS PRESSURE REGULATORS

Pipe line and heater installed on gas line south of Mt. Pleasant, Michigan, by Consumers Gas Company.

Automatic Pipe Line Heating Units Installed by Consumers Power Co.

DUE to extremely low temperatures occuring in central Michigan, pipe-line heating is followed widely by gas transportation companies to prevent accumulation of ice in lines at the low spots. Consumers Power Co., Jackson, Mich., piping gas from fields south of Mt. Pleasant to that city, has installed several units at its measuring stations which are automatic, once they are fired, and have housings that prevent snow and sleet from damaging the burners and thermostats.

The covers which house the burners are of sheet steel, made on location by welding. These houses were built to cover the portion of the meter run which is to be heated, with the roof of the house surrounding the pipe snugly enough so that drifting snow will not sift into the burners at this point. The houses are supported on the ground to prevent vibration, with sufficient space between the lower rim and the ground surface to insure perfect combustion and sufficient draft to carry away the fumes from the burner tips.

The burners were assembled by using a number of reducing tees which are connected to each other to form a long series, with the opening on the upper side, into which short nipples were connected to serve as burner tips. An inspection door was placed in the side of the building to enable the line walker or other employee to light the fires. The cover for this opening was also made of sheet steel. It was fastened to the side of the building with a single rivet, loosely enough that the door may be moved freely, yet snugly enough that wind will not move it when closed.

■ ■

New Johns-Manville Catalog On Industrial Products

The new 1937-38 edition of the Johns-Manville Industrial Products catalog is now available. This 64-page illustrated book contains information and recommendations on high and low temperature insulations for industrial needs; specifications on J-M bonded asbestos built-up roofs, and J-M insulated roofs; detailed information on J-M corrugated transite for roofing and siding; on J-M industrial friction materials; on Transite electrical conduit and korduct, asbestos ebony and other J-M electrical materials; on Transite pressure pipe for industrial and municipal water lines; on Transite industrial vent pipe and stacks; and on J-M packings and gaskets.

The catalog also describes in detail J-M industrial flooring plank, asphalt tile flooring, steeltex floor lath, welded wire reinforcement, and materials for sound control of mechanical equipment.

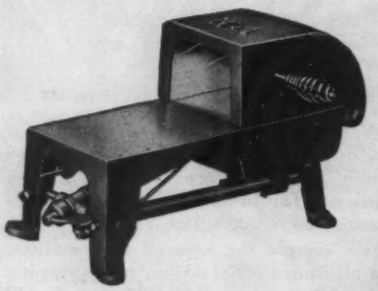
Copies of this book, Form GI-6A. are available upon request to Johns-Manville, 22 East 40th Street, New York City.

■ ■

Three New Clark Compressors Ordered for Iraq

Clark Brothers Co., of Olean, N. Y., announce that the Iraq Petroleum Corp. has ordered three additional 300-hp. Clark balanced opposed electric driven compressors for their crude stabilization plant located at Kirkuk, Iraq. The first of these machines will start on its 8000-mile journey soon.

JOHNSON NO. 1 SOLDERING FURNACE



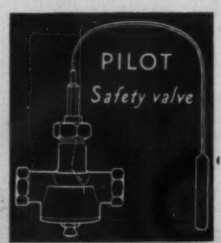
This is a powerful single-burner Bench Furnace designed to heat soldering coppers up to 6 lbs. per pair. Heat-treating, tempering, annealing of small carbon steel tools can be done efficiently and economically in this Furnace. No forced air blast is required. Fire-box has a heavy refractory lining, insuring uniform heat. Equipped with one Johnson Bunsen Burner, with pilot light and shut-off valve. Patented curved shaped hood can be tilted. Write for free catalog.

JOHNSON GAS APPLIANCE CO. Cedar Rapids IOWA

BUILD YOUR HOUSEHEATING LOAD WITH KLIXON CONTROLS

These two advanced Klixon devices give exact automatic temperature control and assure positive pilot protection for your gas-fired space heaters . . . provide sales features that make it easy to sell gas heating.

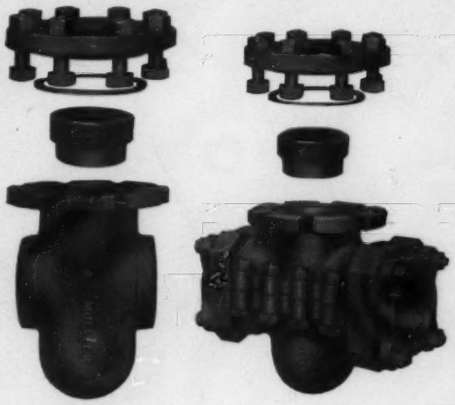
Write today for descriptive bulletins.



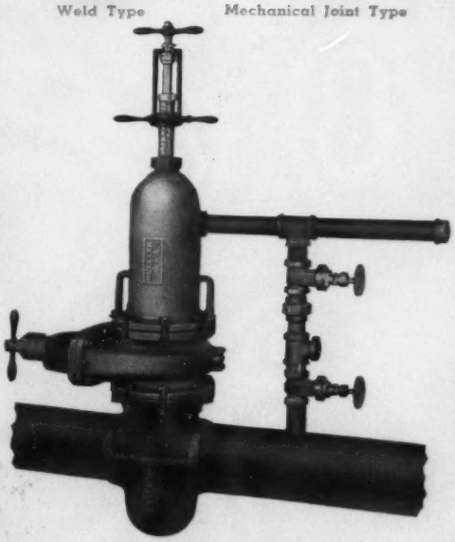
SPENCER THERMOSTAT COMPANY
Unit of Metals & Controls Corporation
87 FOREST STREET • ATTLEBORO, MASSACHUSETTS

JUL 0 1939

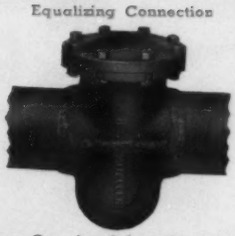
MUELLER PRESSURE CONTROL FITTINGS AND EQUIPMENT SAVE TIME, LABOR COST AND SHUT DOWN LOSS



Weld Type Mechanical Joint Type



Equalizing Connection



Completed Installation

Mueller Pressure Control Fittings are available in weld type for steel pipe and mechanical joint type for steel or cast iron pipe. Fittings and installation tools are made in sizes from 1" to 8" inclusive.

A catalog is ready for you with diagrams of typical installations.

The costly shut-down method of service line repair is now an unnecessary evil. Because shut-down is expensive, dangerous and inconvenient, Mueller offers a means of avoiding it with Pressure Control Fittings and Equipment.

INSTALLED IN EXACT LOCATION DESIRED

Mueller Pressure Control Fittings need not be installed until the occasion arises; then at the exact location desired. They permit the gas supply to be redirected around the section under repair, with positive shut-off. Service is not interrupted. Work goes on with absolute safety.

EXTENSIONS and ALL REPAIRS

Mueller Fittings may be used for extending dead-end lines, lateral extensions and all repairs without loss of gas. With them, the inconvenience and danger of closing and opening lines is entirely eliminated. Consumer satisfaction increases, and company good will never suffers. Workmen are not exposed to the danger of escaping gas.

The use of Mueller Pressure Control Fittings and Equipment is saving thousands of dollars in maintenance for many companies. Write, today, for catalog including complete installation instructions.

WRITE FOR MUELLER PRESSURE CONTROL FITTING BOOK COMPLETE INFORMATION

MUELLER CO. DECATUR, ILL.

MUELLER

MODERN GAS SERVICE EQUIPMENT

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Att: Periodical Division,
Washington, D. C.

SPRAGUE INDUSTRIAL METERS

HIGH & LOW PRESSURE

DEPENDABILITY—ACCURACY—LONGER LIFE

& LOWER OPERATING COSTS

WRITE FOR BULLETINS No. 16A and No. 19

THE SPRAGUE METER CO., BRIDGEPORT, CONN